ARITHMETICAL RULES,

Digested and Contracted

For the Help and Benefit of *MEMORY.*

Very Necessary and Useful, as well for *Gentlemen* and *Tradesmen*, as for *Youth* and *Apprentices*, in *Mercantile Affairs.*

With *EXAMPLES* Illustrated upon the *RULES.*

By ARTHUR LEADBETTER, *Schoolmaster in the* Whiting-street *in* Bury St. Edmonds *in* Suffolk.

Rules *without* Examples *have but little Light, and* Examples *without* Rules *have no Foundation.* Cicero.

In the SAVOY:

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TO THE
READER.

Courteous Reader,

I Having Taught *Arithmetick* in this Town of *Bury St. Edmonds* for several Years past, and observing that very many, who had Learned that Commendable *Art*, in a great part either neglected, or altogether forgot, to retain in Memory the *Rules* and *Terms* of *Art* belonging to that *Science*; the pretended Reason for it being this: *That the Length of the Rules was Overburthensom to the Memory.* The Consideration whereof put me upon this Work of Contraction, hoping that the

Method I have used in this *BOOK* will afford Encouragement, and make some considerable Impression upon such as have Learned, or desire to Learn, this *Art*.

My design at present is to Treat only of such *Heads* of *Arithmetick* as are necessary and proper for Publick Commerce, and to perswade the Learner to retain the *Rules* in his Memory; which are sure Foundations to work his *Operations* by Art. The *Rules* in this *Book* are but short, and the *Examples* not over many, if the *Subject* of every *Chapter*, with its *Branches*, be considered.

I have no end herein, but *Publick Good*, and therefore offer it to thy favourable Acceptation, remaining

A Lover of Arithmetick,

ARTHUR LEADBETTER.

A

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ARITH-

ARITHMETICAL RULES, WITH EXAMPLES:

Briefly compriſed

For the Benefit of APPRENTICES eſpecially.

CHAP. I.

Of the Excellency of Arithmetick.

ARITHMETICK having in it ſelf the Art and Skill of Numbering by Figures, holds forth four undoubted Truths.

1. It claimeth Superiority, because in all the Sciences of the *Mathematicks* it hath the first place, giving Principles to all other Arts, and therefore of it self sufficient.

2. Its beginning is *Unity*, and *Unity* is the beginning of *Number*.

3. Its Subject is *Number*, *Integral* or *Fractional*, composed of many *Units*, as 12 is 12 *Units*, *&c.*

4. Its End is not only *Speculative*, but *Practical*, and therefore named *Practical Arithmetick*, or *The Art of Numbering*.

CHAP. II.
Of NOTATION.

IN *Simple* or *Single Arithmetick*, there is, 1. *Notation*; 2. *Numeration*: The first part shewing how to note down every Number, and then to express it when written down. Hence came the Invention of expressing all Numbers by these Nine Figures, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0; and the Round 0, called a *Cipher*, ordained for no other use, but only to encrease a place.

The

The School-men therefore divided those ten Characters into,

1. *Digits*, as 1, 2, 3, 4, 5, 6, 7, 8, 9.
2. *Articles*, as 10, 20, 30, *&c.*
3. *Compounds*, as 15, 25, 34, *&c.*

A Notation Table.

Third Great Millions.	*Second Great Millions.*	*First Great Millions.*	*Millions.*	*Units.*
142,	340.	647,	895.	762,	348.	345,	672.	987,	432.

The Periods are Ten.

In the precedent TABLE consider,

1. The Original of the Ten Characters before named in *Chap.* 2. some supposing, that the *Indians*, some the *Phœnicians*, and others the *Arabians*, invented them, because neither the *Greeks* nor the *Latines* used them; however they have been retained by the common Consent almost of all People, because most fit to accompt withal, and most commodious for every kind of Practice belonging to this Art.

2. In the Table consider the conjunction of them one with another, wherein you have the valuation of their Places, as *Units*, *Tens*, *&c.* and then their Periods, every Period comprehending two perfect Degrees.

3. In the Table consider the Reading; when you read any Number therein, or any other Number, begin at the left hand, and proceed towards the right; but when you manifest the Value of any Number, then begin at the right hand, and count to the left.

CHAP.

CHAP. III.

Of ADDITION.

THE Second Part of *Simple* or *Single Arithmetick* is *Numeration*; and *Addition* is the first principal kind or part of *Numeration*, which teacheth to add two or more Sums together, either of one, or divers Denominations; and so to expreſs their whole value in one entire Sum called the *Total*.

Now, in *Addition* three Things are to be noted:

1. *Collation*, that is, a true joyning, or exact ſizing of Numbers.
2. *Operation*, *i. e.* a right handling and reckoning of them.
3. *Probation*, *i. e.* proving of them.

So then when any Sum is to be written down,

1. Rank them in due order.
2. Caſt them up exactly.
3. Prove them truly.

Examples of one Denomination.

1. Of single Numbers.	8	3	
	4	|	
	5	|	Proof.
	6	|	
	7	3	
Total-	30		
2. Of two Numbers.	45678	1	
	3427	|	Proof.
Total-	49105	1	
3. Of more than two Numbers.	84567	8	
	2345	|	
	678	|	Proof.
	92	|	
	4	8	
Total-	87686		

The Rule for Proof is this.

Cast away all the Nines in the particular Sums, as also all the Nines in the Total; if the two Remains agree, the Total Sum is true.

Ad-

Addition of divers Denominations, are either,

1. In *Moneys.*
2. In *Weights,*
3. In *Measures.*

1. As for *Moneys* used in *England*; Note, That formerly the Accompts of the Revenues of this Kingdom have been kept in Marks, at 13 *s.* 4 *d. per* Mark; but now generally are kept by Pounds, Shillings, Pence, and Farthings, called *Sterling* Money; some do think the Word comes from the Picture of the Bird called *Starling*, which was stamped upon one part of the Money; some think from a place in *Scotland* called *Striveling* alias *Sterling*; others from the Workmen who were *Esterlings*, who both Coined, and gave Alloy. *Vid.* Vaughan *of Coin and Coinage*, p. 264.

l.	*s.*	*d.*
234	17	8
567	13	9
342	12	7
892	12	9
456	09	6
842	10	4
3336	16	7

Proof 1—1.

Examples.

l.	*s.*	*d.*	*q.*
694	10	8	2
84	09	7	3
26	15	3	2
944	06	4	3
30	07	5	2
78	08	6	3
95	04	7	1
1954	02	8	0

Proof 2—2.

Now

Now to prove such Sums as these, observe this *Rule:*

Cast away the Nines in the particular Sums of the Pounds, double the Remains; if it exceed 9, carry that excess over to the Shillings; then cast away all the Nines in the Shillings, what remains treble, if there be any 9, cast it away, and carry the remain to the Pence; cast away all the Nines in the Pence, and set down the remain at the end of a line; then cast away the Nines in the Total Sum as before, doubling the Pounds, and trebling the Shillings, still carrying the remains to be added to the Pence; if there be any Farthings, put them into Pence, adding them to the Pence: And if the remains of the particular Sums, and the remains of the Total agree, then the Sum is true.

This Rule for Proof is quick in operation, but not sure, for Reasons that may be given; and therefore to prove the Examples of Addition in Money, Weights, and Measures, take this *Rule:*

Cast up a second time all your particular Sums, except the top or uppermost line, then add the second Total to that line, and if it make the just Sum of your first Total, it is true, but otherwise not.

2. As for the *Weights* used in *England*, the first whereof is *Troy Weight*, being 32 Statute Grains; 24 Artificial Grains making one Peny-weight, 20 Peny-weight one Ounce, and 12 Ounces one Pound.

This *Troy* Weight serveth for Gold, Silver, and Electuaries, *&c.* but the Ounce is divided by Physicians into 8 Drams, a Dram or Drachm into 3 Scruples, a Scruple into 20 Grains. But as *Morellus* in Prol. *cap.* 1. saith, By an evil custom it was received into Shops, which ought to have, according to ancient Custom, 24 Grains, and so to have been equivalent with one Peny-weight; so that the number of Grains in the Medicinal Pound and Ounce is the same with that in the *Troy*, the Pound being 5760 Grains, and the Ounce 480 Grains. Dr. *Wybard*, *pag.* 210.

Now from this Pound *Troy* ariseth,

1. Wet Measures, in which all liquid Substances are put, named *Concaves*, the lesser being Pints, Quarts, Pottles, and Gallons.

2. Also from this Pound ariseth Dry Measures, wherein dry Substances are measured, as Corn, Salt, Coal, Sand, *&c.* Other greater Concaves, as Hogsheads, Pipes, Tuns, *&c.* are more fit to contain Li-

Liquor, than to measure them; but here note, That several dry Commodities, as Corn, and Salt, are measured by a different Measure; as also all liquid Measures, of Ale, Beer, and Wine, are found to differ much, both in Quantity it self, and in the Commodity. *Vide* Map of Commerce, *p.* 248. *Specul. Mercat. cap.* 5. Moreover, a Pint, which is the least measure, is found different in its Cubick Inches. *Wybard, p.* 262. *Purcha. patterns, p.* 180, 212.

Example upon the former Heads.

Troy Weight.

	12	20	24
lb.	Oz.	*Penywt.*	Gr.
20	06	18	12
13	08	14	15
36	11	16	18
47	04	12	19
18	03	04	22
Total 136	11	07	14

Liquid Measures.

1. Of Beer.

	2	2	9	4
Bar.	*Kild.*	*Firk.*	*Gall.*	*Quar.*
344	1	1	8	2
645	1	1	7	3
782	1	1	5	2
345	1	1	4	1
678	1	1	3	2
092	1	1	2	3
Total— 2891	0	1	5	1

2. Of Wine.

	4	63	2	2	2
Tun.	*Hogsh.*	*Gall.*	*Pott.*	*Quar.*	*Pt.*
234	2	13	1	1	1
567	3	14	1	1	1
63	2	27	1	1	1
45	1	39	1	1	1
67	2	44	1	1	1
08	3	22	1	1	1
Tot. 987	3	38	0	1	0

Dry

Dry Measures.

	Chald.	*Quar.* 4	*Coom.* 2	*Bush.* 4	*Pecks.* 4
	34	3	1	3	3
	56	2	1	2	2
	78	1	1	3	1
	92	3	1	2	2
	44	2	1	1	3
	76	2	1	2	2
Total —	384	2	0	0	1

Apothecaries Weights in use.

	lb.	*Oz.* 12	*Dram.* 8	*Scrup.* 3	*Gr.* 20
	10	06	4	1	12
	14	11	5	2	15
	15	10	6	1	16
	16	08	7	2	18
Total—	58	02	1	0	01

The Explanation of the *Examples* before depicted, are set over the several Denominations in Figures.

The

The ſecond Common Weight uſed in *England* is *Averdupois* Weight, a French Word ſignifying to have Weight.

This Weight containeth 16 ounces to the pound, and yet in ounces it is leſſer than the *Troy* Weight, becauſe that 14 ounces 12 Peny-weight *Troy* makes one pound *Averdupois*.

Now concerning the proportion between theſe two Weights, ſee Dr. *Wybard*, *pag.* 218. Beſides, from the 16 ounces *Averdupois* three ſeveral *Quintiels* are derived, 'tis a French Word ſignifying an Hundred Weight.

The firſt Quintiel is of Five-ſcore, or 100 pound exact, called the Subtil Hundred, weighing Spices, Drugs, and other fine Commodities; to which is added, an Allowance of 4 pound upon every 104 pound to the Buyer, named *Tret*; which was the practice of *Antwerp* in *Flanders*: *Map. com. pag.* 239.

The ſecond Quintiel is the *Averdupois* great Weight, of 112 ℔. to the hundred, weighing Groceries, Salteries, and all other Garblable Commodities.

The third Quintiel is the Stannary Weight, of 120 ℔. to the hundred; by which Tin, and ſome other few Commodities, are weighed.

Now, as the ſecond Quintiel is diſtinguiſhed into greater Weights, as Quarters 4, Pounds 28, and Ounces 16; ſo out of theſe 16 ounces are derived leſſer Weights, of 20 Grains to the Scruple, 3 Scruples to the Dram, and 8 Drams to the Ounce: Late Writers ſay, 16 drams to the ounce; and yet I find two worthy Writers differ, both in their Rules, and Operations.

1. Mr. *Moore*'s Arithmetick, in the third Table of his Introduction, notes, 8 drams makes one ounce; and yet in his Reduction, *pag.* 59. multiply by 16, the Example is this: 244 lb. 14 *oz.* 11 *dr.* in Operation, *facit* 62699 drams.

2. Mr. *Bridges* in his Arithmetick, *p.* 21. writes 16 drams makes one ounce; and yet in Reduction, his *Rule* is to multiply by ounces to drams 8, and divide by drams to ounces 8, *pag.* 99. His Example is this in *pag.* 101: Reduce 20 lb. 7 *oz.* 5 *dr.* 2 *ſcr.* in Operation *facit* 2621 drams.

The reaſon of this I would willingly underſtand, both their Books being of great worth and account.

To proceed; other Weights are made out of this pound weight of 16 ounces,

as

as Stones, Tods, Cloves, *&c.* but seeing the quantity of these Weights in Flesh, Cheese, and Wool, are not the same in several places; you must therefore, according to the custom of those Places, regulate your Operations.

One Example of Averdupois *Great Weight.*

	C.	*Quar.*	lb.	Oz.
	41	2	13	11
	06	3	06	06
	04	2	13	12
	52	1	09	07
	13	2	08	04
Total-	121	3	23	08

3. As for Measures used in *England*, either in small quantities, by the Yard, containing 36 Inches, or 4 Quarters, and every Quarter 4 Nails; or else by the Ell, containing 45 Inches, or 5 Quarters, whereof 3 Quarters makes one *Flemish* Ell, and every Quarter 4 Nails, with such Advantages as have been allowed. See *Map of Com. chap.* 272.

A few Examples upon this Branch.

	Yards.	4 *Quarters.*	4 *Nails.*
	24	2	2
	56	3	3
	78	2	1
	26	3	2
	39	2	3
	63	1	2
Total —	250	0	1

		5	4
	English *Ells.*	*Quarters.*	*Nails.*
	567	1	2
	678	2	2
	923	3	3
	456	3	1
	72	2	2
	34	3	3
Total —	2733	2	1

Flemish

Flemish *Ells.*	3 *Quarters.*	4 *Nails.*
6789	2	2
456	2	1
72	1	3
34	2	2
56	2	3
78	1	2
Total — 7489	1	1

In the former part of this Chapter you have the Proofs set down.

In the measure of great Quantities, as in Land, take this *Rule:*

Five Yards and an half, or 16 Foot and an half, makes one Perch, Lug, or Pole; 40 Perches one Furlong; and 8 Furlongs one *English* Mile.

Note, That 40 Perches in length, and 4 in breadth, does make one Statute Acre. 33 *Edw.* 1. *de Terris mensurandis.*

Now besides Statute Measure, the Pole varies; for 18 Foot is called Woodland Measure; 21 Foot Church Measure; and 24 Foot Forrest Measure. But I forbear.

Of TIME.

No Affairs whatſoever can be done without *Time*, the External Meaſure whereof is Motion; the Sun meaſures this Motion, either in the whole Year, or in the greater Parts, which are the Months; or in the leſſer Parts, which are the Days; and therefore the Parts of *Time* are thus divided:

60 Minutes makes one Hour.

24 Hours makes one Day natural.

365 Days makes one Year, termed the *Julian* Year; but the *Biſſextile* or Leap-year contains 366 Days.

Moreover, in computation of Time, *Aſtronomers* divide the Year into 12 Months, becauſe the *Sun* runs through the Zodiack, or performs her Courſe through the Ecliptick Line or Path-way of the Sun, in 30 days, making in all 360 days; to which is added, 5 days and 6 hours, according to this Verſe:

I. XV CCC. Sex horas continet annus.

Read it after this manner:

Ter centum, tervigintiCum quinque diebus,
Sex horas neque plus, integer Annus habet.

Eng-

Engliſhed thus:

The Year
Three hundred ſixty five days juſt contains,
With hours ſix, and nothing more remains.

Aſtronomers likewiſe divide the Minutes into other parts, as Seconds, Thirds, Fourths, *&c.*

One Example of Time.

		365	24	60
	Years.	*Days.*	*Hours.*	*Min.*
	24	16	13	15
	185	102	14	22
	67	95	08	31
	276	36	09	23
	45	24	05	42
	67	56	07	53
	3	31	11	28
	4	257	10	39
Total —	672	255	09	13

CHAP.

CHAP. IV.
Of SUBSTRACTION.

Substraction being the Second Part of *Numeration*, is an orderly withdrawing or rebating one Sum or Number out of another, many out of one, or many out of many; or it ſerveth to deduct one Sum out or from another, the leſſer from the greater, and to ſhew what remains.

Here you are to obſerve, that there is,

1. A greater Number.
2. A leſſer Number.
3. A Difference, Exceſs, or Remains.

Which Difference ſome uſed to write above the greater Number, thus:

Remains 309
Abate — 678
From — 987

But now below the leſſer Number, thus:

From — 678
Subſtract 540
Remains 138

In

In Substraction of Numbers of divers Denominations; if the Figures of the lesser Number exceed the greater Number in their Fractional Numerators, borrow 1 of the former, and add to it, remembring to restore that 1 again.

Example.

	l.	*s.*	*d.*	*q.*
From —	645	11	6	2
Substract	437	15	8	3
Remains	207	15	9	3
Proof —	645	11	6	2

Here you see, that 3 Farthings cannot be taken out of 2 Farthings, therefore I borrowed 1 Peny from the Pence, and added the 2 Farthings to it, which made 6 Farthings, now 3 Farthings out of 6 made for the Remain 3, as you may see; then 1 Peny that was borrowed and 8 Pence makes 9 Pence, but 9 Pence out of 6 Pence cannot be, therefore 12 Pence was borrowed from the Shillings and added to the 6 Pence, which made 18 Pence, now 9 Pence out of 18 Pence, and there remains 9 Pence; then 1 Shilling that was borrowed and 15 Shillings made

16 Shillings, which could not be taken out of 11 Shillings; then 20 Shillings is borrowed of the Pounds, and 11 Shillings added to it, makes 31 Shillings, now 16 Shillings out of 31 Shillings, and there remains 15 Shillings; then 1 Pound that is borrowed and 7 Pound makes 8 Pound, which cannot be taken out of 5 Pound, then I borrow 10 Pound of the Pounds and add it to the 5 Pound, which makes 15 Pound, out of which I take 8 Pound, and the remainder is 7 Pound; then 1 Pound that is borrowed and 3 Pound is 4 Pound, which taken out of 4 Pound, and there remains 0; then 4 Pound out of 6 Pound, and there remains 2 Pound.

Obſerve therefore the ſame method in *Weights* and *Meaſures*, wherein Subſtraction is required.

Examples.

Troy Weight.					Engliſh Meaſure.			
	lb.	Oz.	Dwt.	Gr.		Ells.	Qu.	Na.
From	13	7	14	5	From–	146	1	2
Take	11	8	16	7	Subſtr.	98	2	3
Rem.	1	10	17	22	Remains	47	3	3

CHAP.

CHAP. V.

Of MULTIPLICATION.

THe first Part of *Manifold Numeration* is *Multiplication*, and *Multiplication* is *Manifold Addition*; wherein are four Parts:

1. *Unity.*
2. *Multiplicand.*
3. *Multiplicator.*
4. *Product.*

Look how many Units are contained in the Multiplicator, so many Units are contained in the Multiplicand it self.

Example.

Multiply 4 into 6, the Product is 24; because in 4 are 4 Units, add 4 six times to it self, and it maketh 24; then consequently every Number measures it self by Unity.

A Mul-

A Multiplication Table.

A.	1	2	3	4	5	6	7	8	9
1	2								
2		4	6	8	10	12	14	16	18
3			9	12	15	18	21	24	27
4				16	20	24	28	32	36
5					25	30	35	40	45
6						36	42	48	54
7							49	56	63
8								64	72
9									81

In the foregoing TABLE you have,

1. The *Square Numbers*, and their *Sides*, by a Metaphor, commonly called *Roots*; *Sides*, 1, 2, 3, 4, 5, 6, 7, 8, 9; and *Squares*, 1, 4, 9, 16, 25, 36, 49, 64, 81.

2. *Single Multiplication*; as 3 times 4 is 12, 6 times 5 is 30: Where note, That these two Numbers 5 and 6, or any two Num-

Numbers multiplied the one into the other, are called the *Sides*, which hath length and breadth; and the Number produced (as 30) is called a *Plain* or *Superficial Number.*

3. *Compound Numbers*, either when one Figure is Multiplicator to several Figures in the Multiplicand; as,

4567
3
13701

Or when two or more Figures are the Multiplicator; as

2464
36
14784
7392
88704

0
7 X 0 Proof.
0

Now for the Operation of variety of Questions, observe these *Rules:*

1. *Unity* (that is, 1.) neither multiplies nor divides, if you consider Unity abstractly, and of its own nature, so it is indivisible; but concretely, as it is joyned or applied to some Subject or Magnitude, so it is divisible: As a *Jacobus*, or a *Carolus*, cannot be divided as it

is one: yet as it is a piece of Coin, which may be divided into Angels, Crowns, Half-Crowns, Shillings, &c. so it is divisible; besides, Unity is properly no Number, because Number is composed of many Units; yet in regard of the benefit which Number hath by it, and of the excellency it hath in being the beginning of Number, therefore it hath amongst *Arithmeticians* the estimation of being a Number, although the least Number.

2. When the first Character of your Multiplicator is 1, and the rest following are Cyphers, then annex those Cyphers after the Multiplicand, and the Multiplication is compleated.

Example.

34567
1000
34567000

7
7 X 1 Proof.
7

Now because that Cyphers may be added or taken away as there is occasion, therefore *Surveyors* make use rather of 10, 100, or 1000, than any other Number.

3. When

3. When Cyphers are put into the Multiplicator or Multiplier between significant Figures, multiply by the significant Figures, and pass over the Cyphers, proceeding to multiply by the other Figure or Figures, placing every particular Product in its proper place.

Example.

3264	1234
203	3002
9792	2468
65280	370200
662592	3704468

4. If either Multiplicand or Multiplicator, or both of them, end with Cyphers, cut them off, and when you have multiplied by the significant Figures, add them again to the Product.

Example.

230	4526	14500
6	3200	2800
1380	9052	1160
	13578	290
	14483200	40600000

5. When three Numbers are appointed to be multiplied together, this is termed *Continual Multiplication*, and the Product is called a *Solid Number.*

Multiply 4, 5, and 6, the one into the other.

Example.

4
5

20
6

A Solid Number 120

The three Numbers 4, 5, 6, are called *Sides*, which have Length and Breadth. *Euclid, lib. 7. def.* 18.

But when three equal Numbers are multiplied the one into the other, this is called a *Cube Number*, which is equally equal, because produced of three equal Numbers. *Euclid, def.* 20.

Example. 8. 8. and 8.

8

64
8

The Cube 512
---

6. In

6. In *Multiplication Compound*, observe how many Figures the Multiplicator hath, and so many particular Multiplications are to be made out of the Multiplicand, all which being added into one Sum, will afford you the *Factus*, or Product.

Example.

Multiplicand — 2345
Multiplicator — 452

4690
11725
9380

Product — 1059940

5 (1) X (1) 2 Proof.

The Proof is by casting away the 9s, both in the Multiplicator and Multiplicand, and set down the Remains at each side of the Cross; then multiply those two Remains, and if there is any 9, cast it away, and set the Remains at the top of the Cross; then cast away the 9s in the Product, and if the Remains therein agree with the Remains at the top, then is the Sum truly multiplied.

Note, That amongst *Arithmeticians* there is little or no difference in the Rules

of Addition and Subſtraction; but in Multiplication and Diviſion many Bankers and Exchangers have abbreviated their Operations, and ſhortened their Tasks.

As for Example.

If 1 Yard coſt

	l.	*s.*	*d.*
	3	4	6
36			6
	19	7	0
			6
Facit —	116	2	0

, what 36 Yard?

If 1 Ell require

	l.	*s.*	*d.*
	3	13	4
360			9
9	33	00	0
8			8
5	264	00	0
			5
Facit —	1320	00	0

, what 360 Ells?

If

If 1 Piece of Stuff coſt 36 *s.* what 268 Pieces? *The half is* 18

	268
	18
	2144
	268

Anſwer. l. 48 2|8 *s.*

If 1 Pound coſt 4 Shillings, what 100 Pounds? *Anſw.* 20 *l.*

What comes 30 Pieces of blue Liſts to, at 22 *s. per* Liſt?

	22	*Or thus:*	22
Half of 30 *is*	15		30
	110		660
	22	*Anſw.*	33 *l.*
Anſw.	*l.* 33|0		

Other Abbreviations that belong to *Multiplication*, are inſerted in the *Rule of Practice* with Duplation or Duplication, which is multiplying by 2.

CHAP. VI.
Of DIVISION.

THE Second Part of *Manifold Numeration* is *Diviſion*; and *Diviſion* is the very ſame to *Subſtraction*, that *Multiplication* is to *Addition*, for if you add 6 ſix times,

6
6
6
6
6
6

It makes 36

If you multiply 6 by 6, *facit* 36; if you ſubſtract 6 from 6 five times, there will remain 6; and if you divide 36 by 6, the Quotient will be 6.

Now to *Diviſion* belongs,

1. *Bipartition*, meaſuring every equal Number by 2.

2. *Tripartition* by 3; as 54, ſaying, 5 and 4 is 9, which Number 3 meaſures or divides.

3. *Quadripartition*, as 96816 divided by 4, and ſo of the reſt of the Figures to 9.

To

To proceed in *Diviſion*, there are four Numbers or Parts:

1. *Unity*; becauſe as many times as the Diviſor is contained in the Dividend, ſo many times there are Units in the Quotient.
2. *Dividend.*
3. *Diviſor.*
4. *Quotient.*
5. *Remains*; added by ſome as a part of Diviſion.

For the Operation of Queſtions in Diviſion, obſerve,

1. The Order.
2. The Rule.

1. In ordering your Numbers, place the Dividend in the middle, the Diviſor at the left hand, and the Quotient at the right, thus:

Diviſor. Dividend. Quotient.

24) 2468 (102. 20 *Remains.*

2. The *Rule.*

1. Diſtinguiſh by a Point (.) ſo many of the foremoſt places of the Dividend as will contain the Diviſor.

Example. 24) 2648 (

2. Ask how many times, or how often, you may have the Diviſor in the Dividend, thus: 24)2648(1

3. Mul-

3. Multiply that Figure (1) into the Diviſor, and ſet down the Multiplication under the Dividend, and directly under the Point every Figure in its due order; then ſubſtract and ſet down the Remains over the Dividend, thus:

02

24) 2648 (1

24

2

4. Proceed and Point at the next Figure, and look how many Points are made in the Dividend, ſo many Figures expect in the Quotient.

Example.

0

020

24) 264|8 (110—$\frac{8}{24}$ *Remains.*

24

2

Proof 2648 by *Addition.*

5. The Remains are always leſs than the Diviſor, as in the Example above.

6. If the Diviſor have any Cyphers, cut off ſo many Figures or Cyphers in the Dividend towards the right hand as the Diviſor contains, thus:

24|00) 2648|40 (

7. What

7. What Figures remain in the Dividend after the last Substraction, they are the Numerators of a Fraction, which hath the Divisor for its Denominator.

Example.

1
085
24|00) 567|40 (23 $\frac{1540}{2400}$
482
7

This *Rule* is Summed up by the *Handmaid of Arithmetick* in four Words:

1. 2. 3. 4.
Dicquot, Multiplica, Subduc, Transferto, Secantem Divisorem.

Lastly; The more Figures the Divisor hath, the lesser will the Quotient be; *Et contra.*

Now to shew how some *Accomptants* have performed their Divisions, observe what follows.

1. Suppose your Divisor to be 12, 14, 16, 18, 42, or any other Number that may be evenly divided, or parted.

Ex-

Example.

Divide 4628 by 12: But because 2 times 6 is 12, first divide the Dividend by 2, and the Quotient by 6.

```
      4628
     ----
2)    2314
     ----
6)     385 4/6, which is 2/3. Answ.
```

2. Suppose Pence or Halfpence were to be brought into Pounds *Sterling*; now because 240 Pence or 480 Halfpence makes one Pound, therefore cut off the Cypher in the Divisor, and also the Cypher or Figure in the Dividend, and take the Parts of 24 and 48.

Example.

In 467842 Pence, what Pounds *Sterling*?

```
                    000
4 and 6.            0525(2   l.
                    ----
4)46784|2   6)  11696 (1949 1/3 Answ.
                    ....
                    6444
                    525
                    ----
            Proof   11696
```

In

In 36840 Halfpence, what Pounds *Sterling*?

4 and 12.

4) 3684|0

```
        0
       08(9
      ----
12)   9 2 1 (76 l. 3/4. Answ.
      ...
      ----
      8 4 2
        7
      ----
Proof  921
```

3. Suppose that 81 Pieces of Stuff cost 246 *l.* 13 *s.* 6 *d.* what will the Piece cost?

Divide by $\frac{1}{9}$ $\frac{1}{9}$, thus:

Pieces 81.

	l.	*s.*	*d.*	
	246	13	6	
9)	27	08	2	
9)	3	00	$10\frac{8}{9}$	*Facit.*

But if the Divisor have any broken Numbers, the Dividend and Divisor must be brought into one Denomination.

Suppose that 224 *l.* 10 *s.* 6 *d.* will pay for 63 Pieces of Dowlus, what will the Piece amount unto?

Divide by $\frac{1}{7}$ $\frac{1}{9}$.

Pieces 63.

	l.	*s.*	*d.*	
	224	10	6	
7)	32	01	6	
9)	3	11	$3\frac{3}{9}$	*Facit.*

If 360 lb. of Cochanel coſt 1020 *l. Sterling*, what 1 Pound?

		l.	*s.*
Divide by $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{10}$.		1020	00
Pounds 360.	6)	170	00
	6)	$28\frac{1}{3}$	00
	10)	2	$16\frac{2}{3}$ *Facit.*

More of theſe Examples afterwards in Practice.

A Pond containing 3678 ſolid Feet, how many ſquare Yards?

0
10
096(6
27) 3678 (136 $\frac{2}{9}$ Yards *Facit.*
27x2
86
x

Proof 3678

A Debtor owing his Creditor 500 *l.* he agrees to pay him every Week 20 *l.* till the Debt be paid; but upon the firſt Week's Payment, the Debtor prevails with him to pay 5 *l.* weekly out of that

20 *l.*

20 *l.* to another Creditor; *Qu.* How many Weeks before the first Creditor receives his Money?

$$
\begin{array}{r}
0 \\
05(5 \\
\hline
15)\ 500\ (33\tfrac{1}{3}\ \text{Weeks.} \\
45 \\
\hline
50 \\
45 \\
\hline
5
\end{array}
$$

Proof 500

This way of Division is not inferior to any other, if you will take Mr. *Leybourn*'s word in his *Arithmetick*, *pag.* 60. and is no burthen to the Memory.

In the *TABLE* following you have a brief Compendium of the *Power* of *Numbers*; The *Augmentation* from the right hand to the left, and the *Diminution* from the left hand to the right: In short, there is *Multiplication* and *Division* proving each other.

A TABLE of Multiplication *and* Diviſion *proving each other.*

1	1	1	1	1	1	1	1	1
2	256	128	64	32	16	8	4	2
3	6561	2187	729	243	81	27	9	3
4	65536	16384	4096	1024	256	64	16	4
5	390625	78125	15625	3125	625	125	25	5
6	1679616	279936	46656	7776	1296	216	36	6
7	5764801	823543	117649	16807	2401	343	49	7
8	16777216	2097152	262144	32768	4096	512	64	8
9	43046721	4782969	531441	59049	6561	729	81	9

CHAP. VII.
Of REDUCTION.

ALthough *Reduction* is by many Writers furthered as a part of *Arithmetick*; yet properly it is no part, but a Work only depending upon *Multiplication* and *Division*, and is for no other use, but to bring *Moneys*, *Weights*, *Measures*, *Time*, or any other Thing or Things whatsoever, out of one Denomination into another; that is, Things of a gross Denomination are brought into a more subtle Denomination by *Multiplication*; and Things of a more subtle Denomination are brought into a more gross Denomination by *Division*; so that *Reduction* is either Mediate or Immediate, Direct or Indirect.

Reduce 346 Pounds into Pence mediately.

	20		
Shill.	6920	Or immediately.	346
	12		240
	13840		13840
	692		692
Pence	83040	Pence	83040

Bring 46 *l.* 12 *s.* 10 *d.* into Pence.

	20	Or thus:	46
Shill.	932		240
	12	Shill.	1840
	1874		92
	932		154
Pence	11194	Pence	11194

Now for Reducing of several Foreign Coins, observe this Method:

Antwerp in Flanders.

In 45670 *Flemish* Gilders, what Pounds Sterling? Because 2 Shillings is 1 Gilder, therefore divide by $\frac{1}{10}$.

l.

Facit 4567|0

In 2486 Stivers, how many Gilders and Pounds Sterling? Because 20 Stivers is a Gilder, cut off the first Figure towards the right hand, which is 6.

Take half of 248|6

12|4

Divide by $\frac{1}{10}$. *Facit* 12 *l.* 8 *s.*

In

In 4563 Stivers, at 1 *d.* 1 *q.* what Nobles, at 6 *s.* 8 *d?*

0
004(9
32) 22815 (71 $\frac{21}{320}$ *Nobles.*
224z
3
Pr. 22815

20 *Gr.*
16
320 *Gr.*

Stoade in Germany.

In 67456 Rix-dollars, of 50 Stivers for 5 Shillings *Engliſh*, what Pounds Sterling? Divide by 4, becauſe 5 *s.* is one Fourth of 20 *s.*

4) 67456 (16864 *l. Facit.*

Paris in France.

In 4567 Sous, how many French Livers or Franks?

$\frac{1}{2}$) 4567 (2283 Livers *Facit.*

$\frac{1}{10}$. *Facit* 22 *l.* 16 *s.*

In 4567 *French* Crowns at 6 *s. per* Crown, what Pounds?

$\frac{1}{10}$ is 1370|1. *Facit* 1370 *l.* 2 *s.*

Pro-

Portugal in Spain.

In 5678 Mirls or Milts of Gold, how many Reas?

400 Reas make 1 Ducat, and 2 Ducats and an half a Mirle: Therefore,

Multiply 400
By— $2\frac{1}{2}$

800
200

Reas 1000

Facit 5678000 Reas.

Dantzick in Poland.

In 2344 Florins, 228 Groos being given for 1 *l. Flemiſh*, how many Gilders and Pounds Sterling?

Multiply by 30, becauſe it makes one Florin, then multiply the Product by 6 Florins, which are one *Flemiſh* Pound; and laſtly, divide the laſt Product by 228 Groos, and the Quotient gives Gilders; then cut off one Figure to the left hand, and you have Pounds Sterling.

The Operation.

```
                                  2344
                                    30
                                 ------
                   Florins       70320
                                     6
                                 ------
                 Flemish Pounds  421920
                                 ------

        00
        011(1
        1935(2
        ------
228)    421920 (185|0 Gilders.
        ------
        228400
        1824
        11          185 l. Facit.
        ------
Proof   421920
```

Scotch Money.

In 6789 *Scotch* Marks at 13 *d.* 2 *q. per* Mark, what Pounds?

```
  6789          00(4
    27         0399(2          l.
 -----        ------
 47523   48 (18330|3 (381 423/480 Facit.
13578          ------
 -----         14448
183303          384
 -----         ------
        Proof 183303
```

In

In 6384 Cardecues at 18 *d. per* Cardecue, what *Scotch* Nobles at 6 *d.* 3 *q*?

6384
72
12768
44688
459648

00 00
180100
27) 459648 (17024 *Facit.*
27
199
189
108
108
x

Proof 459648

Irish Money.

In 4567 *Irish* Harpers at 9*d. per* Harper, how many Pounds Sterling?

4567
9
41103

000
x73(6
24) 41103 (171 $\frac{63}{240}$ *Facit.*
x484
x62

l.

Proof 41103

Spanish Money.

In 630 *l.* Sterling, how many Ducats of *Spain* at 5 *s.* 10 *d.* Gilders at 3 *s.* 11 *d.* and Rix-Dollars at 4 *s.* 3 *d*?

The

The Operation.

```
 630          00
 240         0140
-----       ------
 252   7|0) 151200|0(2160 Ducats.
 126         ------
-----        1472
151200          4
-----       ------
Proof       151200
```

```
          0
         030
        0168(1
        ------
47)     151200 (3217 1/47 Gilders.
        ------
        141479
          942
           3
        ------
Proof   151200
```

```
          00
         032(3
        01934(6
        ------
51)     151200 (2964 36/51 Dollars.
        ------
        102964
          4500
           22
        ------
Proof   151200
```

It

It is very requiſite for ſuch as intend Merchandize, not only to underſtand the way of Exchanging of Money from one place to another, but alſo the commutation of Wares for Wares, which is termed Bartering or Trucking; and the commutation of Goods for Money, which is called Bargaining or Selling; whereby they will come to underſtand the favourable Cuſtoms and Allowances upon ſome Commodities, called The Courteſies of *London*, as *Groſs*, *Tare*, *Subtle*, *Tret*, *Cloff*, and *Neat*.

The *Rules* therefore for the finding out the Neat Weight are theſe following:

1. If your Weight be entred all into Pounds, then add your Poize or Groſs Pounds into one Total, and ſubſtract the Total of the Tare Pounds from the Groſs, and what remains are Pounds Neat.

Example.

N°	lb.	lb:
1. Poize	316	Tare — 18
2. Poize	214	Tare — 12
3. Poize	304	Tare — 22
Pounds Groſs	834	Tare — 52
Tare —	52	
Neat —	782	

Note:

Note: By the *Tare*, is to be underſtood the Bag, Cheſt, Butt, or any other thing containing the Commodity.

2. If your Weights be entred into Hundreds, Quarters, and Pounds, then reduce your Groſs Hundred into Pounds, or divide the Total of the Tare Pounds into Hundreds, and ſubſtract it from the Groſs Hundred, and you will have the Neat Hundred.

Example of 4 *Hogſheads.*

N°.			C.	*Quar.*	lb.	lb.
1.	120.	Poize—	2	1	04	Tare—18
2.	121.	Poize—	3	2	11	Tare—36
3.	122.	Poize—	2	3	16	Tare—22
4.	123.	Poize—	2	3	14	Tare—44
		Groſs	11	2	17	Tare 120
		Tare—	01	0	08	
		Neat—	10	2	09	

3. If the Tare be ſo much *per* Hundred, Hogſhead, Butt, Bag, Cheſt, Barrel, *&c.* and the Queſtion be put, What Pounds Neat? Then multiply your Pounds Tare into the Hundred, Bag, arrel, *&c.* and ſubſtract the Product from

the Groſs Pounds, and the Remainder is the Pounds Neat.

Example.

	C.
6 Bales of Pepper, ——— Poize	24
130 Pieces of Figs, ——— Poize	56
6 Butts of Alligant, ——— Poize	64
Groſs Hundred	144

Tare 18 lb. *per* Hundred, what Pounds Neat?

	112
	288
144	144
18	144
1152	Groſs 16128
144	Tare 2592
Tare 2592	Neat Pounds 13536

But if the Queſtion had been, What Hundred Neat? Then divide the Pounds Tare by 112, and ſubſtract the Quotient from the Groſs.

Example.

		C.	*Quar.*	lb.
0	Groſs	144	0	00
035(6	Tare	– 23	0	16
) 2592 (23 C.	Neat	– 120	3	12
2246				
336				
Proof 2592				

4. When

4. When you meet with the word (*Each*,) *Alter uter*, or *Unus & alter*, that is, One and the other, have a ſpecial regard thereunto.

Example.

In 3 Cheſts of Sugar, (each) that is, every Cheſt weighs 4 Hundred 2 Quarters and 12 ℔. Tare 27 ℔. *per* Cheſt, what Hundreds Neat?

		C.	*Quar.*	℔.
27	Each Cheſt	4	2	12
3				3
81	Groſs	13	3	08
	Tare	00	2	25
Anſw.	Hundreds Neat	13	0	11

5. When the Tares allowance is an Aliquot, or ſome even Part of 112 ℔. divide the Hundreds, Quarters, and Pounds, by that Part.

Example.

In 342 C. 2 *Quar.* 14 ℔. Groſs, Tare 16 ℔. *per* Hundred, what Hundreds Neat?

Becauſe 16 is one Seventh of 112 lb. divide by $\frac{1}{7}$.

	C.	*Quar.*	lb.	
$\frac{1}{7}$)	342	2	14	Groſs.
	48	3	22	Tare.
Anſw.	293	2	20	Neat Hundreds.

6. To find out the Subtle Tret and Neat, obſerve this *Rule:*

When the Tare Pounds are ſubſtracted from the Groſs Pounds as before, that which remains is call'd Subtle Pounds, which divide by 26, becauſe 'tis contained 4 times in 104 Pounds, (upon what account, ſee *Chap. 3. Quintiel* 1.) and in the Quotient you will have the Tret, which ſubſtract from the Subtle, and the Remains are Pounds Neat.

Example.

8 Bales of *Braz.* Pepper, Poize 38 Hundred 2 Quarters and 14 Pounds, Tare 130 Pounds, and 4 Pounds *per* 104 Pounds Tret, what Pounds Neat?

The Operation.

	C.	*Quar.*	lb.
Poize	38	2	14
	112		
	896		
	3360		
	7		
Groſs	4326		
Tare	130		
Subtle	4196		
Tret	161		
Neat	4035		

00(1
153(0
26) 4196 (161 $\frac{10}{26}$ Tret.
2666
1530
4196 Proof.

Anſwer.

The Fractions of Pounds Weight are not conſiderable amongſt Merchants.

7. To find the *Cloff*, ſo called, becauſe 2 lb. is allowed upon every draught of ſome Commodities which exceedeth 336 lb. or 3 Hundred Groſs. *Map of Com.* p. 245. obſerve this *Rule:*

When the Tret is ſubſtracted from the Subtle, that ſubſtracted Number divide by 300, and that Quotient is the Cloff, which abated from the Tret's ſubſtracted number, produces the Neat.

Ex-

Example.

In 3 Butts, containing 36 C. 3 *Quar.* 15 lb. Tare 380 lb. and 4 lb. *per* 104 lb. Tret, and 2 lb. on every Butt, that contains above 300 Weight for Cloff, what Neat Pounds?

	C.	*Quar.*	lb.
	36	3	15
	4		
	147		000
	28		111 (8
	1192		26) 3752 (144 Tret.
	294		2644
Gross	4132		1108
Tare	380		4
Subtle	3752		3752 Proof.
Tret	144		
Cloff	12		3) 3608 (12 Cloff
Neat	3596	*Answ.*	

Bought of *J. S.* for the Account of *A. C.* of *Bury St. Edmonds*, 40 Pigs of Lead; 10 Pigs

	C.	*Quar.*	℔.		C.	*Qu.*	℔.
10 Pigs, Weight	12	3	14				
10 *Ditto*	13	1	15				
10 *Ditto*	24	2	11		67	2	00
10 *Ditto*	16	2	16				

How many Fother at 19 Hundred and an half?

```
     036                                  18
     ---  Fother.                        ---  Foth.
78) 270 (3 6/13.   Or thus: 39) 135 (3 6/13
    234                         117
    ---                         ---
Pr. 270                  Proof  135
```

In Reduction of Measure note, That 3 Fifths of an Ell *English*, that is, 12 Nails, is one entire *Flemish* Ell; therefore,

If 1 Ell *Flemish* be $\frac{3}{5}$ *English*, what 2346 *Flemish* Ells?

```
   3                 0
 ----               200(3
 7038               ----
                 1/5) 7038 (1407 3/5 English.
                      ....
                      5005
                      2 3
                      ----
                Proof 7038
```

Or

Or thus:

```
                2346
                  12
               ----
               4692
              2346
              ----
                |1
The half of  2815|2
             ----
   Facit     1407  Ells English.
             ----
```

Sold *G.H.* 20 Pieces of Cambrick each $34\frac{1}{2}$ Ells *English*, how many Pieces each 28 Ells?

```
  2          69
 --          20
 56         ----
 --    56) 1380 (24 9/14 Pieces Facit.
```

As for the reducing the greater Parts of *Time* with the whole Year into the lesser Parts, or bringing the lesser Parts into the greater, the beginning of this Chapter will instruct you; but yet to acquaint you a little more with the Division of the greater Parts of *Time* by a little Digression, observe that there are three sorts of Months:

1. *Solar*; that space of Time which the Sun spendeth in passing through any of the 12 Signs.

2. *Lu-*

2. *Lunar*; that ſpace of Time which the Moon, while ſhe's departing from the Sun, returneth to him again.

3. *Uſual*; that number of Days ſet down in our Common Kalender, whereof ſome Months contain 30 days, ſome 31, and *February* 28 days, according to this General Rule:

Thirty days hath September,
April, June, *and* November;
All the reſt hath Thirty and One,
Excepting February *alone.*

And further; In the Revolution of *Time* four Things are conſiderable:

1. The *Circle* of the *Sun.*
2. The *Golden Number.*
3. The *Dominical Letter.*
4. The *Epact.*

1. It is called the *Circle* of the *Sun*, becauſe the Sun in 4 times 7, that is, 28 Years, makes his Revolution, and finiſheth his Circular Courſe. *Galtruc. p.* 166.

2. The *Golden Number* is ſo termed, becauſe *Julius Cæſar* writ it in his Kalender in Golden Letters, and that becauſe in 19 Years ſhe makes her ſeveral Changes and Motions, and returns again where ſhe firſt began. *Alſ. lib.* 1.

3. The

3. The *Epact* is a certain Number not exceeding 30 Days, so that the *Lunar* Year is lesser than the *Solar* by 11 Days, from whence the *Epact* takes its Original. *Blund. p.* 655.

Now to find out the *Circle* of the *Sun*, note this *Rule:* Add 9 to any Year of our Lord, and divide the Total by 28, and the Remain is the Circle.

Example.

```
1689        00|1
   9   28) 169|8 (60.   18 is the Circle.
----        1680
1698        ----
            1698 Proof.
```

To find out the *Golden Number*, observe this *Rule:* To any Year of our Lord add 1, and divide the Total by 19, (omitting the Quotient) and the Remain is the *Golden Number*.

Example.

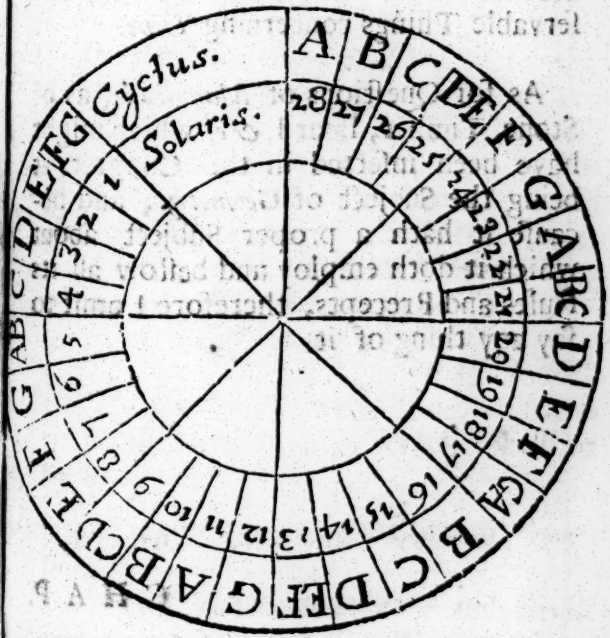
```
     1689
        1
    ----
19) 1690 (88.   18 is the Golden Numb.
```

To find the *Dominical Letter*, the following Circle will help you; and because the Week contains 7 Days, therefore

fore 7 Letters were appointed, what's the *Dominical Letter* for the Year 1689?

According to former *Rule* I find out the *Circle* of the *Sun* for this Year, which is 18, then counting backward I find the Letter *F* ſtanding over its head, which is the *Dominical Letter* for this Year.

The Circle.

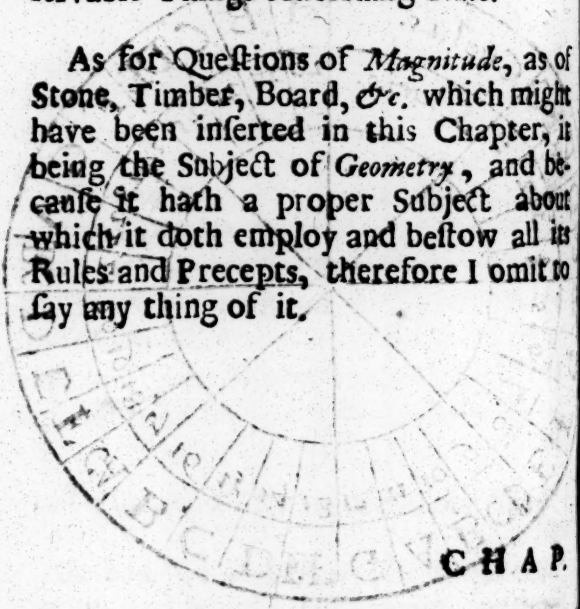


To find the Epact for this Year 1689.

First, find out the *Golden Number*, which is 18, then multiply that by 11, *facit* 198; which Product divide by 30, and the Remain is [18,] which is the *Epact*.

And thus I have given you some short account of the Parts, and of some observable Things concerning *Time*.

As for Questions of *Magnitude*, as of Stone, Timber, Board, *&c.* which might have been inserted in this Chapter, it being the Subject of *Geometry*, and because it hath a proper Subject about which it doth employ and bestow all its Rules and Precepts, therefore I omit to say any thing of it.



CHAP.

CHAP. VIII.

Of Notation of Fractions.

THE Natural Diſpoſition of *Fractions* is conſidered,

1. In *Notation.*
2. In *Valuation.*
3. In *Reduction.*

1st. In *Notation* of *Fractions*, there is a Line drawn between the Superior Part called the *Numerator*, and the Inferior Part named the *Denominator*, thus $\frac{2}{3}$, becauſe the Figure which is above the Line ſheweth the Parts of the Integer, and the Figure below the Line ſheweth into what Parts the Integer may be divided.

Example.

Suppoſe 1 *l.* Sterling to be divided into three Parts, and two of thoſe Parts are to be diſtributed, as afterward ſhall be ſhewn.

2ly. In *Valuation* of *Fractions*, conſider,

1. That if the *Numerator* and *Denominator* be equal, the *Fraction* is equivalent with the *Integer*.

Example.

$\frac{4}{4}$ is equivalent to 1 *l.* Sterling; this is termed *Proportion Rational* of *Equality*. *Euclid, lib.* 5. By *Bill, p.* 127.

2. If the *Denominater* be leſs than the *Numerator*, it is an improper Fraction, and exceeds the *Integer* by ſo many Units as the *Numerator* doth the *Denominator*.

Example.

$\frac{4}{3}$ is $1\frac{1}{3}$. $\frac{13}{7}$ is $1\frac{6}{7}$.

Here you may diſcern *Proportion* of *Inequality*, of comparing greater Quantities to the leſſer, or the leſſer Quantities to the greater, wherein Proportion hath five Terms:

Firſt; Of Proportion of the greater to the leſſer.

1. *Multiplex*; as 4 to 2, 9 to 3.

2. *Superparticular*; as 6 to 4, equivalent to $1\frac{2}{4}$.

3. *Superpartiens*; as 7 to 5, 9 to 7.

4. *Multiplex ſuperparticular*; as 7 to 3, 9 to 2.

5. *Multiplex ſuperpartiens*; as 8 to 3, 11 to 4.

Secondly; Proportion of the leſſer Quantity hath as many kinds as that of the greater, only put the Word or Preposition

position [*Sub*] to all the foregoing Names, as *Sub multiplex*, *Sub superparticular*, *&c.* As 5 to 7 ſtands thus $\frac{5}{7}$, ſo 2 to 3 ſtands thus $\frac{2}{3}$. See *Billingsley* upon *Euclid*, *lib.* 5. and others, as *Leeke* and *Serle*.

2. Conſider that if the *Numerator* be leſs than the *Denominator*, it is a proper Fraction; as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{20}{30}$, $\frac{160}{240}$, $\frac{144}{960}$, *&c.*

Now to find the value of a proper Fraction, multiply the Numerator by the Diminute Parts, and divide the Product by the Denominator, and the Quotient will ſhew the value or worth of it.

Example.

$\frac{2}{3}$ *l.*

2
20

3) 40 (13 $\frac{1}{3}$ Shillings.

$\frac{8}{10}$ of a Crown; multiply 8 by 10, becauſe 10 Sixpences is a Crown, and divide by 10, *facit* 4 *s.*

$\frac{16}{20}$ of a Noble, *facit* 5 *s.* 4 *d.*

16
20

32|0
15 Groats.

To find the value of an improper Fraction, divide the Numerator by the Denominator, and the Quotient shews the value.

$\frac{7}{3}$ is $2\frac{1}{3}$, which is as much as 7 to 3, termed *Sesquitertia.*

$\frac{24}{5}$ is $4\frac{4}{5}$, which is as much as 24 to 5, named *Super quadripartiens*; and this is *Geometrical Proportion.*

3[17]. In *Reduction* of *Fractions* consider, whether the Parts are to be brought into their lesser Terms, or into one Denomination; if into their lesser Terms, which is called *Abbreviation of Fractions*, find out what Digit will measure or divide both the Numerator and Denominator.

Example.

$\frac{32}{64}$. Either 2, 4, or 8, will measure it, thus $\frac{16}{32}$, $\frac{8}{16}$, $\frac{4}{8}$, $\frac{2}{4}$, $\frac{1}{2}$: This $\frac{1}{2}$ is equivalent to $\frac{32}{64}$.

But in case you cannot find readily the Digit or Figure that will divide both the Numerator and Denominator, then by a *General Rule* divide the Denominator by the Numerator, and by the Remains divide your Divisors till nothing remains; then if you divide both the Numerator and Denominator of your Fra-

Fraction by your last Divisor, the Quotient will give you two Numbers, the first a Numerator, and the other a Denominator.

Example.

Abb. $\frac{1215}{1701}$

```
        0(486
1215) 1701 (1
      1215
```

```
      0(243
486) 1215 (2
      972
```

```
      000
243) 486 (2
      486
```

243 is Divisor to the Fractions.

```
      0000
243) 1215 (5. Numerator.
      1215
```

```
      0000
243) 1701 (7. Denominator.
      1701
```

Which $\frac{5}{7}$ is equivalent to $\frac{1215}{1701}$.

Sometimes no Figure will divide the Numerator and Denominator equally, but Unity, that is, [1.] as in this

Example. $\frac{3845}{4517}$

Further; If in Reduction of Fractions the Parts are to be brought into one denomination, observe these following *Rules:*

1. When you reduce or bring a whole Number into an improper Fraction, as 40, 18, 260; put the whole Number for Numerator, and 1 for Denominator, thus: $\frac{40}{1}$ $\frac{18}{1}$ $\frac{260}{1}$.

2. When you reduce a mixt Number, as $6\frac{2}{4}$, into an improper Fraction, multiply the whole Number by the Denominator, and to the Result add the Numerator: *Facit* $\frac{26}{4}$.

3. When you reduce a Fraction improper into a whole or mixt Number, as $\frac{44}{8}$, divide the Numerator by the Denominator, and the Quotient is $5\frac{4}{8}$.

4. When you reduce Fraction of Fractions into a single Fraction, as $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}$, multiply the Numerators continually for one Numerator, and multiply all the Denominators continually for one Denominator; *Facit* $\frac{2}{24}$.

5. When you would reduce two Fractions or more of unequal Denominations into one Fraction, as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, multiply the Denominators of the Fractions into one another continually for a common Denominator; then multiply

every

every Numerator into all the Denominators, except its own, for a single Numerator, and add all the Numerators together for one common Numerator.

Example.

l.	*l.*	*l.*		
1	2	3	12	
2	3	4	16	
			18	
			46	Common Numerator.
			24	Common Denominator.

6. When the Numerator and Denominator is equal, the Fraction is said to be an Unity, or 1, as $\frac{a}{8}$ is one entire Number.

CHAP. IX.

Of the several kinds of Fractions.

CONcerning the several kinds of Fractions, as *Addition*, *Substraction*, *Multiplication*, and *Division*, by some called *Essential Numeration*, because the Parts are either numbered by their Increasement or Decreasement.

Addi-

Addition.

In *Addition*, when you have by Reduction brought the broken Parts or Fractions into one denomination, add the Numerators together, and place the Common Denominator under the Total.

Example.

Add together. $\frac{2}{3}\ \frac{3}{4}\ \frac{4}{5}$

40
45
48

133 Which is $2\frac{13}{60}$.

Common Denom. 60

But if the broken Parts or Fractions be of one denomination, add only the Numerators together, and put the Total over the Common Denominator.

Example.

$\frac{7}{8}\ \frac{6}{8}\ \frac{4}{8}\}\ \frac{17}{8}$ which is $2\frac{1}{8}$.

Substraction.

In *Substraction* of Fractions it is expedient, that both the broken Numbers have one Common Denominator, and then take the lesser Numerator from the greater, and set the Remains over the Common Denominator.

Exa-

Example.

Take $\frac{2}{3}$ from $\frac{1}{4}$, but first reduce them, $\frac{8}{12}$ $\frac{9}{12}$, and the Remain is $\frac{1}{12}$: Abate $2\frac{5}{6}$ from $4\frac{7}{8}$, but reduce only the Fractions $\frac{5}{6}$ $\frac{7}{8}$, $\frac{20}{48}$ $\frac{42}{48}$, and the Remain is $2\frac{22}{48}$.

Multiplication.

In *Multiplication* of Fractions, infold or multiply continually the Denominators, and likewise the Numerators, each into other.

Example.

Multiply $\frac{1}{4}$ *l.* by $\frac{2}{3}$ *l.* *Facit* $\frac{2}{12}$ *l.*

Multiply $4\frac{5}{6}$ by $2\frac{7}{8}$.

$\frac{29}{6}$ $\frac{23}{8}$. *Facit* $\frac{667}{48}$.

Here you may conclude, that the Parts found out are less than the Parts multiplied, contrary to Multiplication of whole Numbers, for 3 *l.* multiplied by 2 *l.* *facit* 6 *l.* but $\frac{1}{4}$ multiplied by $\frac{2}{3}$, *facit* $\frac{2}{12}$, abbreviated is $\frac{1}{6}$, which is but 10 *s.*

Division.

In *Division* of Fractions, if the Fractions or Parts be of one denomination, as $\frac{6}{20}$ divided by $\frac{3}{20}$, then divide the Numerator 6 by 3, *facit* $\frac{2}{20}$: But if the Parts be

be of contrary denominations, as $\frac{7}{8}$ divided by $\frac{3}{4}$, then multiply the Numerator of the Diviſor into the Denominator of the Dividend for Diviſor, likewiſe multiply the Numerator of the Dividend into the Denominator of the Diviſor for Dividend and the Quotient upon Diviſion will appear as in the Example following.

Divide $\frac{7}{8}$ by $\frac{3}{4}$.

Dividend. 28

$\frac{3}{4} \times \frac{7}{8}$

24 *Diviſor.*

24) 28 ($1\frac{4}{24}$ *Quotient.*

In dividing improper Fractions, firſt reduce them, and then diſpoſe of them according to the former *Rule.*

Example.

How many times is $\frac{3}{4}$ contained in $4\frac{4}{5}$?

96

$\frac{3}{4} \times \frac{24}{5}$

15

15) 96 ($6\frac{6}{15}$ *Quotient.*

Here might be ſhewn, a whole Number divided by a Fraction, as 16 by $\frac{7}{10}$, *facit* $\frac{160}{7}$.

Or a ſingle Fraction dividing ſeveral Fractions, as $\frac{3}{8}$ dividing $\frac{3}{5}$, $\frac{4}{12}$, $\frac{1}{6}$, *&c.*

40

$\frac{3}{8} \times \frac{4}{6}$

18

$\frac{40}{18}$ *Facit.*

Or

Or whole Numbers divided by whole or mixt Numbers, as 26 divided by $3\frac{2}{5}$, *Facit* $\frac{130}{17}$.

But the Demonstration of such *Examples* as these are largely set out by others, and yet are comprehended under some of those *Rules* in this and the precedent Chapter.

CHAP. X.

Of PRACTICE.

SOme call it the *Merchant's Rule*, because many Bankers and Exchangers in Foreign Parts have made compendious and very brief Operations where Unity (or 1) possesseth the first place; and therefore, many Questions may be abbreviated, and performed with quicker expedition than by the *Rule of Three*.

This *Rule* necessarily hath attending upon it the Aliquot Parts of Unity, sometimes by the Numerator multiplying, and the Denominator dividing, and sometimes only by Mediation.

Now by Aliquot Parts understand, certain Times, divers Times, when a lesser

leſſer Number meaſures a greater; As 3 added to it ſelf four times makes 12, *Euclid*, *lib.*7. *def.* 3. compar'd with *lib.*5. *def.* 1. So 5 is a part of the Number 15: Some call this kind of Part, *Pars menſurans*, the Meaſuring Part; ſome the Multiplying Part; ſome the Aliquot Part, becauſe it meaſureth its whole Number. *Barlaam* terms it, *Pars Aliquanta*; but this Aliquant Part in Numbers is not named by *Euclid* a Part, but Parts; as 3 is not a Part of 5, but 3 fifth Parts of 5. *Bill.* on *Euclid*, *lib.* 7. *def.* 4. *L.* and *S.* *lib.* 5. *def.* 1.

In Practical Operations it is certain, that if the Price of any Commodity be the even Parts of Unities, either Pounds, Shillings, Pence; Hundreds, Quarters, Pounds, *&c.* you have your liberty to bring them into the fitteſt known Parts, either Mediately, or Immediately.

Example.

At an Half-peny *per* ℔. what 3680 ℔?

I. Mediately.

3680

$\frac{1}{2}$) 1840 Pence.

$\frac{1}{12}$) 15 $\frac{1}{3}$ Shill.

$\frac{1}{20}$) 7 *l.* 13 *s.* 4 *d.* *Facit.*

II. Immediately.

032 *l. s. d.*

48) 3680 (7.13.4 *Facit.*

336

Where the Price is not an Even or Aliquot Part of Unities, as of 12 *d.* or 20 *s.* or the like, there also you have liberty of taking the Even Parts out of those Unities.

Example.

At 9 *d. per* lb. what 2346 lb.?

For 6 *d.* take ½.	1173
For 3 *d.* take ¼.	586 ½
Shillings	1759

½. *Facit* 87 *l.* 19 *s.* 6 *d.*

At 17 *d.* what 3456?

Shillings—	3456
For 4 *d.* ⅓.	1152
For 1 *d.* ¼.	288
Shill.	4896

½. *Facit* 244 *l.* 16 *s.*

A Table of PRACTICE.

S.	D.	Q.	Parts of a Peny.		Pts. of a Shill.		Parts of a L.
0	0	1	1/4		1/48		1/960
0	0	2	1/2	Or	1/24	Or	1/480
0	0	3	3/4		1/16		1/320
0	1	0			1/12		1/240
0	2	0			1/6		1/120
0	3	0			1/4		1/80
0	4	0			1/3		1/60
0	5	0				Or	1/48
0	6	0			1/2		1/40
0	7	2					1/32
0	8	0					1/30
0	10	0					1/24
1	0	0					1/20
1	3	0					1/16
1	4	0					1/15
1	8	0					1/12
2	0	0					1/10
2	6	0					1/8
3	4	0					1/6
4	0	0					1/5
5	0	0					1/4
6	8	0					1/3
10	0	0					1/2
12	0	0					1/2 1/10
12	6	0					1/2 1/8
13	4	0					1/2 1/6
15	0	0					1/2 1/5
16	0	0					1/2 1/4
16	8	0					1/2 1/3

Take for,	
D.	S.
5.	1/4 & 1/8
7.	1/3 1/4
8.	1/3 1/5
10.	1/2 1/3
11.	1/2 1/4 1/8

A Table *of* PRACTICE.

Ounces Averdupois.	*Pts of* lb.	*Pounds Averdupois.*	*Pts of C.*	lb. *Av.*	*Pts of C.*	1 lb. *Av.*	*Pts of C.*
1	$\frac{1}{16}$	7	$\frac{1}{16}$	28	$\frac{1}{4}$	1	$\frac{1}{112}$
2	$\frac{1}{8}$	8	$\frac{1}{14}$	56	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{336}$
4	$\frac{1}{4}$	14	$\frac{1}{8}$	4	$\frac{1}{28}$	$\frac{1}{2}$	$\frac{1}{224}$
8	$\frac{1}{2}$	16	$\frac{1}{7}$	2	$\frac{1}{56}$	$\frac{1}{4}$	$\frac{1}{448}$

The foregoing *TABLES* you must necessarily commit to memory; and whether the Parts be even, or uneven, of *Farthings*, *Pence*, *Shillings*, and *Pounds*; or *Ounces*, *Pounds* weight, *&c.* Questions may be done very speedily, and with few Figures. Further observe in the *Tables*,

1. *Notation* of Fractions, as $\frac{7}{8}$ *l.* $\frac{5}{8}$ *c.* $\frac{1}{16}$ *C.*

2. *Valuation* of Fractions, $\frac{1}{16}$ *C.* is 7 lb. according to the *Rule* in *Chap.* 8.

3. *Abbreviation* of Fractions; 17 *s.* 6 *d.* having 35 Sixpences, and 40 Sixpences making one Pound, is thus abbreviated:

$$5) \frac{35}{40} \left(\frac{7}{8} \right.$$

Numerator. *Denominator.*

Examples upon the precedent TABLES.

16 Pieces of Tape, containing 480 Yards, at 2 *q. per* Yard, how much will it amount unto?

The Operation.

24) 480 (20 *s. Answer.*

At 3 farthings *per* Ell, what 9867 Ells?

(11 *s.*
16) 9867 (61|6
Facit 30 *l.* 16 *s.* 8 *d.* 1 *q.*

At 3 halfpence *per* lb. what 6452 lb?

(4 *s.* *d.*
½) 6452 (80|6——6.
Facit 40 *l.* 6 *s.* 6 *d.*

At 7 pence ½ peny *per* lb. what 3426 lb?

l. (2
⅓) 3426 (107 *l.* 1 *s.* 3 *d. Facit.*

At 1 *s.* 1 *d.* what 630 lb?

1/12) 52 ½
68|2
34 *l.* 2 *s.* 6 *d. Facit.*

At 3 *s.* 4 *d.* what 845?

⅓) 845 (140 *l.* and ½, which is 16 *s.* 8 *d.*

Sup-

Suppose 40 C. $\frac{1}{7}$ Gross allow 16 lb. Tare *per* C. what's the Tares allowance?

Because 16 lb. is $\frac{1}{7}$ of 112 lb. therefore,

	C.	C.	*Qu.*	lb.	
$\frac{1}{7}$)	40 $\frac{1}{2}$	(5	3	4	Allowance *Facit.*

But when the price of any Commodity is made up of divers Denominations or Names, as *Pounds, Shillings, Pence, Farthings, &c.* or the Commodity that is bought being of one Denomination or Name, and the Total Sum to be paid, is required; then the *Operation* may be variously performed:

Example.

At 4 *l.* 6 *s.* 3 *d.* 2 *q.* *per* C. what 9 C?

Facit 38 *l.* 16 *s.* 7 *d.* 2 *q.*

At 3 *l.* 12 *s.* 8 *d.* 2 *q.* *per* Yard, what 64 Yards and an half?

	l.	*s.*	*d.*	*q.*
	3	12	8	2
				16
	58	03	4	0
				4
	232	13	4	0
	1	16	4	1
Facit	234	09	8	1

If 6 C. cost 26 *l.* 13 *s.* 4 *d.* what's the price of 1 C? *Division* is here requited.

	l.	*s.*	*d.*	*q.*
	26	13	04	0
6)	4	08	10	2 $\frac{2}{3}$ *Facit.*

Many more Questions might be proposed, but because you may see the Excellency of this *Rule*, the following Question in its Varieties will discover it.

The Question.

At 2 *l.* $\frac{5}{6}$ *per* Ell, what are 180 Ells worth?

Variety I.

1.	2 $\frac{5}{6}$.	180.	
$\frac{1}{1}$.	$\frac{17}{6}$.	180.	*Facit* 510 *l.*

Variety II.

At 2 *l.* 16 *s.* 8 *d.* *per* Ell, what 180 Ells?

	l.
2 times 180 *l.* is	360
16 times 180 *s.*	144
8 times 180 *d.*	6
Facit	510

Variety

Variety III.

At 2 *l.* 16 *s.* 8 *d. per* Ell, what 180 Ells?

		l.
	2 times 180 *l.* is	360
½ *l.*	5 times 180 *s.*	45
	5 times 180 *s.*	45
	5 times 180 *s.*	45
1 *s.*	$\frac{1}{20}$ part of 180 *s.*	9
6 *d.*	$\frac{1}{40}$ part of 180 *s.*	4 ½
2 *d.*	$\frac{1}{120}$ part of 180 *s.*	1 ½
	Facit	510

Variety IV.

At 2 *l.* 16 *s.* 8 *d. per* Ell, what 180 Ells?

	l.
2 times 180 is	360
$\frac{4}{5}$ parts of 180	144
$\frac{1}{30}$ part of 180	6
Facit	510

Variety V.

At 2 *l.* ½ *per* Ell, what 180 Ells?

	l.
½ parts of 180 is	150
2 times 180	360
Facit	510

Variety

Variety VI.

At 2 *l.* 16 *s.* 8 *d. per* Ell, what 180 Ells?

	s.
56 times 180 *s.* is	10080
$\frac{2}{3}$ parts of 180 *s.*	120
	10200
Facit	510 *l.*

Variety VII.

At 2 *l.* 16 *s.* 8 *d. per* Ell, what 180 Ells?

s.	*d.*		*l.*
		2 times 180 is	360
6	8	$\frac{1}{3}$ of 180	60
6	8	$\frac{1}{3}$ of 180	60
3	4	$\frac{1}{6}$ of 180	30
		Facit	510

Variety VIII.

At 2 *l.* 16 *s.* 8 *d. per* Ell, what 180 Ells?

l.	*s.*	*d.*	
2	16	8	
2)	5	13	4
9)	51	00	0
10)	510	00	0 *Facit.*

Variety IX.

At 56 *s.* $\frac{2}{3}$ *per* Ell, what 180 Ells?

170 times 180 Groats is —— 30600

Facit 510 *l.*

Variety X.

At 2 *l.* 16 *s.* 8 *d. per* Ell, what 180 Ells?

Abate 3 *s.* 4 *d.* 180 *l.*

then take $\frac{1}{3}$ of 180. 3

540

Substract 30

Facit 510 *l.*

Variety XI.

At 56 *s.* 8 *d. per* Ell, what 180 Ells?

l.

8 times 180 *d.* is —— 6

56 times 180 *s.* —— 504

Facit 510

Variety XII.

At 56 *s.* $\frac{2}{3}$ *per* Ell, what 180 Ells?

l.

For 50 *s.* — 2 *l.* $\frac{1}{3}$ —— 450

For 6 *s.* 8 *d.* $\frac{1}{3}$ of 180, is 60

Facit 510

Va-

Variety XIII.

At 56 *s.* 8 *d. per* Ell, what 180 Ells?

17 times 180 is —— 3060

s. *d.*

3 4 $\frac{1}{2}$ part, *Facit* —— 510 *l.*

Variety XIV.

At 56 *s.* 8 *d. per* Ell, what 180 Ells?

34 times 180 is —— 6120

s. *d.*

1 8 $\frac{1}{17}$ part, *Facit* —— 510 *l.*

Variety XV.

At 56 *s.* $\frac{2}{3}$ *per* Ell, what 180 Ells?

170 times 180 is —— 30600

$\frac{1}{3}$ part is —— 10200

Facit 510 *l.*

Variety XVI.

At 56 *s.* $\frac{2}{3}$ *per* Ell, what 180 Ells?

l.		*l.*	*s.*	*d.*	
3	less by	00	03	4	(5)
15	less by	00	16	8	(4)
60	less by	03	06	8	(3)
180	less by	10	00	0	
540	less by	30	00	0	(3)

Less 30

Facit 510

Va-

Variety XVII.

At 56 *s.* $\frac{2}{3}$ *per* Ell, what 180 Ells?

	l.
40 times 180 *s.* is	360
10 times 180 *s.* —	90
$6\frac{2}{3}$ times 180 *s.* —	60
Facit	510

Variety XVIII.

At 2 *l.* 16 *s.* 8 *d.* *per* Ell, what 180 Ells?

	l.
$\frac{1}{30}$ part of 180 is —	6
$\frac{1}{4}$ part —	45
$\frac{1}{5\frac{1}{2}0}$ part —	09
$\frac{1}{2}$ is —	90
2 times 180 is —	360
Facit	510

Variety XIX.

At 56 *s.* $\frac{2}{3}$ *per* Ell, what 180 Ells?

	l.
20 times 180 *s.* is —	180
20 times 180 *s.* —	180
$\frac{1}{2}$ 10 times 180 *s.* —	90
5 times 180 *s.* —	45
1 time 180 *s.* —	9
$\frac{3}{5}$ parts is —	6
Facit	510

Va-

Variety XX.

At 56 *s.* $\frac{2}{3}$ *per* Ell, what 180 Ells?

17|0	1530
8 $\frac{1}{2}$	
	$\frac{1}{3}$. *Facit* 510 *l.*

Many more Changes might be set down, but these at present may suffice.

Likewise many Questions of Interest have dependance upon this *Rule*, but I omit them till I come to the *Rule* it self, and Treat in the next Chapter of *The Golden Rule*, or *Rule of Three.*

CHAP. XI.

Of the Golden Rule, or Rule of Three.

THE *Golden Rule* is grounded upon the 13th Proposition of *Euclid*, *lib.* 7. which answers to the 16th Proposition of his 5th Book, and that according to *Def.* 6. of the same Book.

That if there be four Proportionals, then alternately also they shall be Proportional, as 4, 8, 32, 64, where the result of the two Extreams 4 and 64 producing

cing 256, is equal to the Result of the two Means 8 and 32, which also is 256; or if 8 and 32 (the two Means) be multiplied, and the Product thereof divided by 4, (the first Extream,) the Quotient will be 64; From hence is the 4th Number found out, which bears such proportion to one Number given, as the other two Numbers given have one to the other; therefore upon this account it is called *The Rule of Three.*

In the *Single Rule of Three direct*, or *indirect*,

1st. Consider the placing of the Terms or Numbers.

The first and third Number must be of one Denomination or Name, likewise the second and fourth; but in case that any, or all, of the three Numbers be of several Denominations, first reduce them, and then orderly place them.

Example.

If 4 ⟋ 12 require,

what 34? ⟋ 102 *Facit.*

When 4 ℔. 2 *Oz.* cost 7 *s.* 6 *d.* how much 16 ℔. 8 *Oz?* Reduce them, and they stand thus:

Oz. *d.* *Oz.* *d.*

66 — 90 — 264 — 360 *Facit.*

2ly. Consider the Number or Term upon which the Question depends, which for the most part is the third Number, having these two Words *What*, and *How*, and the first Extream, usually, *If*, and *When*, as before.

3ly. Consider of the Question proposed, whether it belongs to the *Rule* direct or indirect; to know which, observe this *Rule*:

If the third Number require more for the fourth Number, then let the greater of the two Extreams multiply the middle Number, and divide the Product by the lesser Extream: But if the third Number require less, then let the lesser of the two Extreams multiply the second Number, and the greater Extream divide the Product. *Example.*

I lent my Friend 100 *l.* freely for 9 Months, how long ought he to lend me 80 *l.*?

100 *l.* — 9 Months.

80 — 11 $\frac{1}{4}$ Months *Facit.*

If a Bushel of Wheat at 4 *s.* allow 15 *Oz.* for the Peny Loaf, what must the Loaf weigh at 5 *s.* 6 *d. per* Bushel?

d. *Oz.* *d.* *Oz.*

48 — 15 — 66 — 10 $\frac{10}{11}$ *Facit.*

Both

Both these *Rules* direct and indirect are found to be true, being *Geometrical Proportion*, which is Equality of Reason, in regard of the Quotients appearing of the Numbers compared.

In this *Rule* sometimes *Addition* is required.

Example.

	l.	*s.*
A Merchant buys 60 Butts of *Province* Oyl for ——	340	00
And disburseth for Litherage, Cranage, Wharfage, Porters, and Coopers, ——	14	10
For Custom ——	06	05
For Expences ——	03	00
He desires to gain ——	90	00
In all	453	15

At what Rate shall he sell the Butt?

Butt.	*l.*	Butt.	*l.*	*s.*	*d.*	
60 —	453 ¾.	1 —	7	11	3	*Facit.*

Sometimes *Substraction* is required.

Example.

Suppose a Cooler hath two Spouts, and the one avoideth into a Brewer's Fat (containing 120 Barrels) 8 Barrels every hour, and out of the other Spout there runs 14 Barrels, *Qu.* In what time will the Fat be filled?

Subſtract 8 out of 14, and there remains 6.

	Barrels.	*Hour.*	*Barrels.*	*Hours.*	
Then	6 ——	1.	120 ——	20	*Facit.*

Sometimes (and very often) *Reduction* is required.

Example.

48 Bags of *Barbadoes* Cotton Wool, weight 64 *C.* 3 *Quar.* 6 ℔. Groſs, Tare 480 ℔. at 3 *l.* 4 *s. per C.* Neat.

	C.	*Qu.*	℔.
Groſs	64	3	6
Tare	4	1	4
Neat	60	2	2

	C.	*Qu.*	℔.
	60	2	02
	3		
	l.	*s.*	
	180	00	
$\frac{1}{5}$)	12	00	
$\frac{1}{2}$)	1	13	
$\frac{3}{7}$) *Facit*	193	13	

14 Rolls of *Spaniſh* Tobacco weighing 12 *C.* 8 ℔. Tare 12 ℔. *per* Roll, and 4 ℔. *per* 104 ℔. Tret, at 6 *s.* 8 *d. per* ℔. Neat.

The

	C.	Qu.	lb.
The Operation.	12	0	8
	112		
	232		
	112		
Gross	1352		
Tare	168		
Subtle	1184		
Tret	45		
Neat	1139		
$\frac{1}{3}$	379	$\frac{2}{3}$	*l. Facit.*

Sometimes *Addition* and *Reduction* is required.

Example I.

7 Pieces of Cloth, 294 $\frac{3}{4}$ Ells long, at 41 Stivers, how many Pounds Sterling?

First Piece —— Ells long	42 $\frac{2}{3}$
Second Piece	41 $\frac{1}{2}$
Third Piece	40 $\frac{1}{2}$
Fourth Piece	44 $\frac{1}{4}$
Fifth Piece	41 $\frac{1}{4}$
Sixth Piece	42
Seventh Piece	42 $\frac{3}{4}$
Ells long	294 $\frac{3}{4}$

Ells 294 3/4
41

294
11760 3/4
3

Stivers 1208|4

Gilders 60|4

Facit 60 *l.* 8 *s.* 5 *d.*

In the *Example* aforegoing you may obſerve, That in *Holland* the *Flemiſh* Ell is divided into 4 Quarters, and each Quarter into 3 Nails; but here in *England* 3 Quarters make one *Flemiſh* Ell, and 4 Nails one Quarter, as I noted before in *Addition of Meaſure.*

Example II.

A Dining-Room 12 Foot high, 18 Foot long, and 15 Foot broad, is to be hung with Tapeſtry, how many Ells muſt the Upholſterer bring to hang it?

Yards high.	*Long.*	*Broad.*	
4	6	5	
24	20		
24	20		
48	40	5. 88. 4.	4) 440 (110
40			
88			

Ells.

Then 110. 5. 4. 4) 550 (137½ *Answ.*

Or thus:

25. 88. 16. 16) 2200 (137½ *Answ.*

Infinite are the Questions in all Sciences, which might be stated in this *Rule.*

Now to proceed to the *Rule of Three* in Fractions.

CHAP.

CHAP. XII.

Of the Rule of Three in Fractions.

IN the *Direct Rule* three Numbers are required; Multiply the Numerator of the first Term into the Denominator of the other Fractions for a new Denominator, then multiply the Denominator of the first Fraction into the Numerators of the rest for a new Numerator, which new Fraction is the 4th Number enquired for.

Example.

Ell.	*l.*		*Ell.*	*l.*		*l.*	*s.*	*d.*
$\frac{3}{5}$	$\frac{5}{6}$.	What	$\frac{4}{5}$	$\frac{100}{60}$?	*Facit*	1	13	4.

If any of the Numbers prove a mixt Number, first reduce it into its Improper Fraction, and then work as before.

Example.

If $58\frac{3}{7}$ *C.* cost 234 *l.* what $7\frac{1}{4}$ *C*?

$\frac{409}{7}$ $\frac{234}{1}$ $\frac{29}{4}$. *Facit* 29 *l.* 2 *s.* 1 *d.*

If any of the three Numbers prove a Compound, reduce it into proper or single Fractions.

Ex-

Example.

If $\frac{2}{3}$ of $\frac{3}{4}$ *l.* of $\frac{4}{5}$ buy $\frac{3}{4}$ of a Yard, what will $\frac{15}{20}$ *l.*?

$\frac{24}{60}$ *l.* $\frac{3}{4}$. $\frac{15}{20}$ *l.* *Facit* 1 Yard $\frac{13}{32}$ abb.

In the *Reverse Rule of Three in Fractions*, multiply the Numerator of the third Term into the Denominators of the second and first Term continually, so is the Result a new Denominator, which, with its Numerator produced, will answer the Question propounded.

Example.

If a Piece of Land be 40 Pole long and 4 Pole broad, which is an Acre, what breadth will make an Acre 27 $\frac{1}{4}$ Pole long?

$\frac{40}{1}$ $\frac{4}{1}$ $\frac{109}{4}$. *Facit* $5\frac{25}{109}$ Pole in breadth.

If 3 $\frac{3}{4}$ C. of Provision serve 28 Men 18 $\frac{1}{2}$ days, how many Men will the same quantity serve $6\frac{3}{10}$ days?

$\frac{37}{2}$ $\frac{28}{1}$ $\frac{63}{10}$. *Facit* 82 Men.

Note: Before you state any Question propounded, either belonging to the *Rule direct*, or *indirect*, consider whether *Reduction*, *Addition*, *Subtraction*, *Multiplication*, or all of them, be proposed in the Question; if so, then have recourse

to

to the ſeveral foregoing *Rules* in the 8th and 9th Chapters, and upon ſtating the Queſtion, the firſt and third Numbers muſt be of one Denomination as before.

Example I.

How much will $\frac{4}{8}$ of an ounce be worth, when $2\frac{1}{2}$ *C.* $6\frac{1}{3}$ *lb.* coſt $4\frac{7}{8}$ *l?*

$\frac{1374\frac{4}{3}}{}$ $\frac{39}{8}$ $\frac{4}{8}$. *Facit* $\frac{468}{79616}$ *l.*

Example II.

What will $\frac{1}{4}$ times $\frac{1}{4}$ of the $\frac{1}{8}$ of $16\frac{1}{8}$ *l.* be valued at, when $4\frac{1}{4}$ times $4\frac{1}{4}$ coſt $2\frac{1}{3}$ times $2\frac{1}{3}$ *l?*

$\frac{289}{16}$ $\frac{49}{9}$ $\frac{129}{768}$. *Facit* $\frac{2107}{41616}$ *l.*

The *Operation* of the laſt Queſtion at large.

$4\frac{1}{4}$ $4\frac{1}{4}$ — $\frac{17}{4}$ $\frac{17}{4}$. Multiplied, *facit* $\frac{289}{16}$ for the firſt Number.

$2\frac{1}{3}$ $2\frac{1}{3}$ — $\frac{7}{3}$ $\frac{7}{3}$ Multiplied, *facit* $\frac{49}{9}$ for the ſecond Number.

$\frac{1}{4}$ of $\frac{1}{4}$ of $\frac{1}{8}$ of $16\frac{1}{8}$ *l.* reduced, ſtands thus, $\frac{1}{4}\frac{1}{4}\frac{1}{8}\frac{129}{8}$; multiplied, maketh for the third Number $\frac{129}{768}$: Then place the Numbers thus, as before.

$\frac{289}{16}$ $\frac{49}{9}$ $\frac{129}{768}$. *Facit* $\frac{2107}{41616}$ *l.*

The

The Numbers being ſet in their proper places, multiply the Numerator of the firſt Fraction into the other two Denominators, and the laſt Product abbreviated is 41616 for the Denominator; then multiply the Denominator of the firſt Fraction into the two Numerators of the other Fractions, and the laſt Reſult abbreviated is 2107 for the Numerator.

Example III.

What will $\frac{1}{4}$ of 8 Yards leſs by $\frac{1}{5}$ of a Yard amount unto, when $\frac{1}{8}$ of 7 Yards leſs by $\frac{1}{4}$ of a Yard coſt $\frac{1}{3}$ of 12 $\frac{1}{2}$ *l.* leſs by $\frac{1}{8}$ of 1 *l*?

The Operation.

$\frac{1}{8}$ of $\frac{7}{1}$ $\quad \frac{7}{8}$ $\quad \frac{1}{4}$ $\quad \frac{28}{56}$ $\quad \frac{22}{24}$ } Abbreviated, is $\frac{11}{12}$ for the 1ſt Numb.

$\frac{1}{3}$ of $\frac{25}{2}$ $\quad \frac{25}{6}$ $\quad \frac{1}{8}$ $\quad \frac{150}{144}$ $\quad \frac{144}{36}$ } Abbreviated, is $\frac{4}{1}$ for the 2d Numb.

$\frac{7}{4}$ of $\frac{8}{1}$ $\quad \frac{8}{4}$ $\quad \frac{1}{5}$ $\quad \frac{40}{35}$ $\quad \frac{35}{20}$ } Abbreviated, is $\frac{9}{5}$ for the 3d Numb.

The Queſtion then ſtands thus:

$\frac{11}{12}$ $\quad \frac{4}{1}$ $\quad \frac{9}{5}$. *Facit* $7\frac{47}{55}$ *l.*

By theſe few Examples foregoing it is apparent, that *Reduction*, *Abbreviation*, and

and the ſeveral kinds of Fractions, as *Addition*, *Subſtraction*, and *Multiplication*, are to be made uſe of, before ſuch Queſtions can be truly ſtated and anſwered.

CHAP. XIII.

Of Multiplied Proportion, called The Double Rule of Three.

BEcauſe many Queſtions herein may be performed by a double working, this *Rule* therefore, and many other following *Rules*, proceed from that one precedent *Rule of Three*, being the Foundation and Baſis; and beſides, it keeps its place, and is not excluded from almoſt all Queſtions, as *Gem. Friſius*, *p.* 59.

Now I have found it by Experience, that young Learners, eſpecially in Queſtions wherein five Terms have been propounded, and a ſixth Proportion demanded, have ſooner wrought ſuch Queſtions by the *Double Rule*, than by the *Rule of Five* Compound, called alſo the *Aſcending Rule*, and the *Deſcending Rule*: To inſtance in a few Examples.

This

This *Rule of Five* Compound is branched out into four Parts.

Part I.

If 100 *l.* — in 12 Months
gain 10 *l.* — what will 500 *l.*
gain in 17Mo? — *Facit* 70 *l.* 16 *s.* 8 *d.*

In this *Example*, the first and second Numbers multiplied together make the Divisor, and the other 3 Numbers multiplied continually make the Dividend.

Part II.

If 755 *l.* — in 84 Months
gain 105 *l.* — in what Mon. will 60 *l.*
gain 10 *l.*? — *Facit* 100 $\frac{2}{3}$ Months.

In this *Example*, the third and fourth Numbers multiplied together, make the Divisor; and the first, second, and fifth Numbers multiplied continually, makes the Product to be Dividend.

Part III.

If 60 *l.* — require 200 *Fren.* Cr.
and 14000 *Fren.* Crowns — be worth 14400 Du.
How many Pounds Sterling in 90000 Ducats? — *Facit* 26250 *l.*

In this *Example*, the second and fourth Numbers make the Divisor; and the first, third,

third, and fifth Numbers multiplied, make the Dividend.

Part IV.

If 60 *l.* be 200 *French* Cr.
and 14000 *Fr.* Cr. 14400 Ducats,
How many Ducats in 26250 *l.* 90000 Duc. *Facit.*

In this *Example*, the first and third Numbers make the Divisor, and the second, fourth, and fifth Numbers make the Dividend.

I say therefore, to find the Numbers whereupon the Question dependeth, or to find either the Divisor or Dividend, does often puzzle the Learner; but these and other Questions of this nature proposed and performed by the *Double Rule*, or by the *Rule of Three* twice repeated, makes the *Operation* easy, and encourageth the Learner to farther Practice, because the first and third Numbers in both Works are of one denomination; and oftentimes the fourth Number in the first Work is the second Number in the second *Operation.*

To repeat then, and state, the former Questions.

Que-

Question I.

If 100 *l.* in 12 Months gain 10 *l.* what will 500 *l.* gain in 17 Months?

The Operation.

12 *Mon.* 10 *l.* 17 *Mon.* $14\frac{2}{3}$ *l.*

Again:

100 *l.* $14\frac{2}{3}$ *l.* 500 *l.* *Facit* $70\frac{5}{8}$ *l.*

Question II.

If 755 *l.* in 84 Months again 105 *l.* in how many Months will 60 *l.* gain 10 *l.*?

The Operation.

755 *l.* 105 *l.* 10 *l.* $8\frac{250}{755}$ *l.*

Again:

$8\frac{250}{755}$ *l.* 84 *Mo.* 10 *l.* *Facit* $100\frac{2}{3}$ *Mo.*

Question III.

If 60 *l.* be worth 200 *French* Crowns, and 4000 *French* Crowns be worth 14400 Ducats of *Spain*, how many Pounds Sterling make 90000 Ducats of *Spain*?

The Operation.

200 *Cr.* 60 *l.* 14000 *Cr.* 4200 *l.*

Again:

Ducats.	*l.*	*Ducats.*	*l.*
14400.	4200.	90000.	*Facit* 26250.

Question IV.

[Which is the Proof of the former.]

If 60 *l.* Sterling be 200 *French* Crowns, and 14000 *French* Crowns be worth 14400 *Spanish* Ducats, how many *Spanish* Ducats are contained in 26250 *l.*?

The Operation.

200 *Cr.* 60 *l.* 14000 *Cr.* 4200 *l.*

Again:

l.	*Ducats.*	*l.*	*Ducats.*
4200.	14400.	26250.	*Facit* 90000.

In these *Operations* you may easily perceive, that in regard the first and third Terms, as also the second and fourth, are of one denomination, therefore such-like Questions as these may more plainly be discovered, and their Answers truly known by this *Double Rule*, rather than by the *Rule of Five* Compound.

CHAP.

CHAP. XIV.

Another Branch proceeding from the Golden Rule; or, The first kind of Manifold Proportion, called, Partnership.

Partnership is of necessary Use amongst Merchants, because when two or more Partners put in their Stocks together, each particular Partner will have his proportionable Gain discovered and allotted unto him.

In *Partnership* therefore, without or with equal Time, the *Rule* is this:

The Partners whole Stock is the first Number in the *Rule of Three*; the Gain or Loss the second Number; and each Partner's different Stock is the third Number.

Example I.

Two made a Stock to Trade withal for two Years, *A.* put in 340 *l.* *B.* put in 150 *l.* they gained in Trading 200 *l.* what must each have of the Gain?

l.	*l.*	*Gain.*	*l.*	*l.*	*Gain.*
340	490	200	340	138	38/49
150					
490	490	200	150	61	11/49
	Proof	138	38		
		61	11		
	L.	200	49		

Example II.

Three Merchants laded a Ship, *l.*

The first adventured	372
The second	413
The third	663
The whole Adventure	1448

By Tempest at Sea cast over Board the value of 460 *l.* what is each Man's Loss?

	l.		*l.*		*Parts.*
Stock	1448	Loss	460	What	372
	1448		460		413
	1448		460		663
The first lost			118		256 *Parts.*
The second			131		292
The third			210		900
		Proof	460		1448

According to *Euclid, Lib. 7. Prop.* 12. if there be a multitude of Numbers how many

many ſoever proportional, *As* one of the Antecedents, *Is* to one of the Conſequents: *So* are all the Antecedents, *To* all the Conſequents.

1. In the Queſtion foregoing you have the Antecedents of one Proportion put down ſeverally, and that is the Partners whole Stock, in the firſt place.

2. The Conſequents joyntly added together, and that is the Common Loſs or Gain in the ſecond place.

3. Every particular Partner's Stock is ſet down in the third place.

4. Producing the Conſequents of every particular Antecedent in the 4th place.

Example III.

Four Merchants made a Company or Stock of 600*l.* in Trading they loſt 200*l.* To make therefore this Loſs good, the firſt did contribute 30*l.* the ſecond 50*l.* the third 20*l.* how much then did every one put into Stock?

Here are four Antecedents, one whereof is not expreſſed, but yet ſubſtracted, the fourth may truly be diſcovered.

30
50
20
100

Which Subſtracted from 200
100
Remains 100
Which

Which Remains is the fourth Merchant's proportion in the Loss: Therefore,

	l.	*Stock.*	*l.*	*l.*	
If	200	600	30	90	—1. Merchant.
	200	600	50	150	—2. Merchant.
	200	600	20	60	—3. Merchant.
	200	600	100	300	—4. Merchant.
				Proof 600	

Example IV.

Five made a Bargain, that of their Gains the second should have twice as much as the first, and the fourth thrice as much as the fifth: The first laid into Stock 140 *l.* the third 80 *l.* the fifth 100 *l.* in Trading they have got 120 *l.* and they are at a loss in the division of their Shares. To help them therefore,

Laid down. l.	*l.*	*Gain.*		*l.*
1. Man 140	900	120	140	18 $\frac{6}{9}$
2. Man 280	900	120	280	37 $\frac{2}{9}$
3. Man 80	900	120	80	10 $\frac{6}{9}$
4. Man 300	900	120	300	40 $\frac{0}{9}$
5. Man 100	900	120	100	13 $\frac{1}{9}$
900			Proof	120

Ex-

Example V.

[I propose this following Objection, because of an Objection made against it.]

Three Merchants in Company gained 100 *l.* whereof for the 32 *l.* which the first Man put in he had of the Gains 25 *l.* and of the rest of the Gains the third Merchant had one fourth part more than the second; now the Question is, What the second and third Merchant put into Stock?

The Operation.

From — 100 *l.*
Deduct— 25
Remains 75

Now in regard that the third Merchant must have 5 *l.* for the second Merchant's 4 *l.* I add them together and say,

	l.		*l.*	
If 9	75	4	33 $\frac{1}{3}$.	4
9	75	5	41 $\frac{2}{3}$.	5
				9

Now to find out their Stocks:

l.	*Stock.*	*l.*	*Stock.*
If 25	gain 32	what 33 $\frac{1}{3}$.	*Facit* 42 $\frac{2}{3}$.
25	32	41 $\frac{2}{3}$.	53 $\frac{1}{3}$.

The Objection made against the former part of the Question, is this:

That

That I give the third Merchant 41 $\frac{2}{3}$ *l.* which exceeds 33 $\frac{1}{3}$ *l.* (the second Merchant's Share) not by $\frac{1}{4}$ of the rest of the Gains, but by 8 $\frac{1}{3}$ *l.* which is but $\frac{1}{4}$ of the second Man's Share.

Answ. The Intendment of the Question is not to have the third Merchant take the 4th part of 75 *l.* which is 18 $\frac{3}{4}$ *l.* but he is to have $\frac{1}{4}$ more than the second Merchant. If the second Merchant have 4 *l.* then is he to have 5 *l.* And therefore, according to the Hypothesis or Supposition whereupon the Argument is grounded, it is thus made evident.

	l.		*l.*
The third Merchant is to have	5	For the second Merchant's	4
	5		4
	5		4
	5		4
	5		4
	5		4
	5		4
	5		4

Five Nobles 1 *l.* 13 *s.* 4 *d.* for four Nobles 1 *l.* 6 *s.* 8 *d.*

And 41 $\frac{2}{3}$ *l.* for 33 $\frac{1}{3}$ *l.*

So that the third Merchant is to have really 5 times 8 *l.* 6 *s.* 8 *d.* or 8 times 5 *l.* and 5 Nobles for the second Merchant's 4 times

4 times 8 *l.* 6 *s.* 8 *d.* or 8 times 4 *l.* and 4 Nobles. Besides, if this satisfy not, I will prove it by false Position.

Suppose what Number you please, only choose such a Number wherein the Parts may be evenly and equally divided. Suppose the 2d Merchant, of 75 *l.* had 32 *l.* Then $\frac{1}{4}$ more for the 3d Merchant—40 *l.*

72 *l.*

	l.		*l.*	
Then, If	72	75	32	$33\frac{1}{3}$ Gain.
	72	75	40	$41\frac{2}{3}$

By this it is clear, that the $\frac{1}{4}$ of the rest of the Gains is $41\frac{2}{3}$ *l.* for the third Merchant.

In Parntership with Time, observe this *Rule:*

The particular Stocks of each Person multiplied by their time of Continuance, and added together, makes the first Number in the *Rule of Three.*

The Gain or Loss, the second Number.

And every particular Stock multiplied by its time of Continuance, the third Number.

Example I.

Three Merchants made a Stock to Trade withal; *A.* put in 200 *l.* for 4 Months;

4 Months; *B.* 300 *l.* for 6 Months; *C.* 400 *l.* for 9 Months; they gained 260*l.* what is each man's Portion.

The Operation.

l.	*Mo.*	*l.*	*l.*	*Gain.*		*l.*	
200.	4.	800	6200	260	800	33	34
300.	6.	1800	6200	260	1800	75	30
400.	9.	3600	6200	260	3600	150	60
		6200			Proof	260	124
							62

Example II.

Two made a Stock; the first put in 260 $\frac{1}{3}$ *l.* for 4 Months, and the second put in 180 $\frac{2}{3}$ *l.* for 14 Months; they gained a considerable Sum of Money, whereof the first was allotted him 120*l.* what was then the second to have?

260 $\frac{1}{3}$	180 $\frac{2}{3}$
781	542
4	14
3124	2168
3	542
	7588
	3

3124

$$\begin{array}{rrr} 3124 & 120 & 7588 \\ \underline{3} & \underline{1} & \underline{3} \\ & & 360 \\ \hline & & 455280 \\ & & 22764 \\ \hline & & \end{array}$$

9372) 2731680 (291 $\frac{4428}{9372}$ *l.* *Facit.*

Example III.

Three made a Stock; *A.* put in 120 *l.* on *Jan.* 1. 1674. and took back again 30 *l.* on *June* 30. *B.* put in 50 *l.* on *April* 1. and took out 30 *l.* on *July* 31. and on *October* 1. he laid in again 65 *l.* *C.* laid in 45 *l.* on *March* 25. and 50 *l.* more on *June* 24. and on *Sept.* 29. he took out 24 *l.* At the Year's end the whole Gain was 274 *l.* *Qu.* What is *A.* *B.* and *C.* to have for their Money and Time?

Note: Where Money is taken out of Stock, there *Substraction* is required; and where Money is put into Stock, there *Addition* is required.

The Operation.

l.

120—6—720
30
90—6—540 } *A.* his Money and Time.
1260

l.

50—4—200
30
20—2— 40 } *B.* his Money and Time.
65
85—3—255
495

l.

45—3—135
50—3—150
95
24
71—3—213 } *C.* his Money and Time.
498

l.

Total Numbers { *A.* 1260, *B.* 495, *C.* 498

In all 2253

If

l.	*l.*	*l.*	*l.*	*Parts.*
If 2253	gain 274	1260	153	531
2253	274	495	60	450
2253	274	498	60	1272
		Proof	274	2253

Many Queſtions more might be here inſerted of Variety, but being tedious in their Operations, I do omit them.

CHAP. XV.

A third Branch proceeding from the Golden Rule, and the ſecond kind of Compound or Plural Proportion, is called Alligation; Barnardus Salignacus, *an eminent Mathematician, being Author thereof.*

THIS *Rule* is of great uſe in the mixture of Metals, Coin, and divers other Commodities; as alſo in the Compoſition of Medicines, which deſerves a Tract by it ſelf.

In *Alligation*, obſerve,

1. The Nature and Quality of the *Rule*, that the ſeveral Meaſures or Quantities be of the ſame kind or likeneſs.

2. The Price of the tempered or mixt Measure, that it is to be in Quantity indifferent, or mean, between the Rates of the Measures severally set down.

Example.

Suppose 3 Bushels of Wheat of 15 *s.* were to be mingled with 4 Bushels of Wheat of 28 *s.*

1. The Measures are alike named *Bushels.*

2. The Price of a mingled Bushel between 15 *s.* and 28 *s.* is called the *Mean.*

Note: That the Price of a simple Measure is named the *Extream*, and the Price of a mixed Measure is termed the *Mean.*

Further *Note*, the kinds of *Alligation*,

1. *Alternate.* 2. *Medial.*

First, *Alternate:* When the several Prices are set down under one another with the common Price at the left side, take especial notice of these three Things:

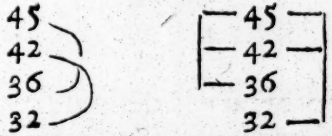
1. That a lesser *Extream*, which is under the common Price, is to be linked or joyned with a greater *Extream*, which is above the common Price, thus:

40 { 45, 42, 36, 32 }

2. If

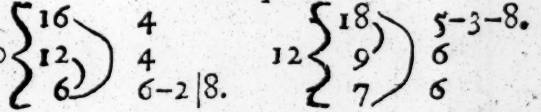
2. If every Number of the *Extreams* prove to be a Number of *Multitude*, then they may be diverſly knit and counterchanged; and though there be ſeveral Anſwers, yet all, or every one, of them will prove true.

Example.



3. If there be but one ſingle *Extream*, that Number muſt be alligated and tyed to all the reſt, which are Plural.

Example.



In this firſt kind, or Prime *Alligation*, there are three Changes.

Change I.

If no quantity of Simples or Parcels be nominated, but only the price of every Simple, and it be required how to mix them together; to find out the common Price or mean Rate of that one Mixture, the *Rule* is this:

Set down (as in *Sect.* 1.) the ſeveral Prices under the other, then link them together one above the common Price with one of the other under the common Price, and the difference above the common Price ſhall be ſet againſt the other linked with it underneath the common Price, *& contra*; then ſet down the Total of the Difference underneath.

Example.

An Apothecary is deſired to compoſe an Ingredience of four ſorts of coſtly Drugs, *viz.* of 45 *s.* 42 *s.* 36 *s.* and 32 *s.* *per* Ounce, how may a Compoſition be made by him to be ſold at 40 *s.* *per* Ounce?

s.	Oz.		*s.*	
45	8	There muſt be of	45	*Per*
42	4		42	
40				
36	2		36	Ounce.
32	5		32	
19				

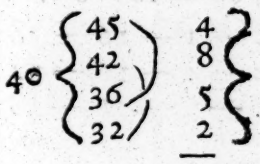
To prove this, multiply the Total of the Differences into the common Price; and if the Product be equal with the Total of all the Products of the Extreams multiplied into their particular Differences, then is the Sum true.

Ex-

Example.

40	45	8	360
19	42	4	168
760	36	2	72
	32	5	160
			760

Had they been linked in this manner following, the *Answer* would have been true.



Change II.

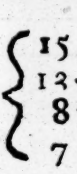
If the Price of every Parcel be set down, and the Measure or Quantity of one of the Simples be expressed, then to find out the Quantity of the rest, the *Rule* is,

Alligation Alternate, and the *Rule of Three.*

Example.

16 Bushels of Wheat worth 15 Groats *per* Bushel, is to be mixed with Rye at 13 Groats, Barley at 8 Groats, and Oats at

at 7 Groats; how many Bushels of the other sorts must I commix therewith, that the Bushel may be sold for 9 Groats?



15	2	Wheat.
13	1	Rye.
8	4	Barley.
7	6	Oats.

Then, if 2 Bushels of Wheat require one of Rye, what 16? *&c.*

2 — 1 — 16 — 8
2 — 4 — 16 — 32
2 — 6 — 16 — 48

To prove it:

Bushels.		*Groats.*			
16	at	15	——	240	16
8	at	13	——	104	8
32	at	8	——	256	32
48	at	7	——	336	48
				936	104
					9
					936

Change III.

If none of the Quantities but the Price or Rate of every Simple be named, then to find out how much must be taken

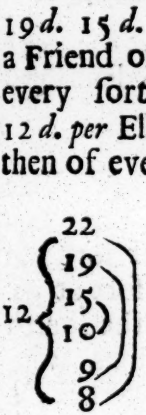
to

to make up a certain Quantity to ſell at a Medium, or mean Rate, the *Rule* is this:

1. *Alligation Alternate.*
2. *Addition* of the *Differences.*
3. The *Rule of Three.*

Example.

A Merchant bought Canvas at 22 *d.* 19 *d.* 15 *d.* 10 *d.* 9 *d.* and 8 *d. per* Ell, a Friend of his deſires 1000 Ells, and of every ſort a parcel to ſtand him in 12 *d. per* Ell one with another, how much then of every ſort is to be taken?



				Ells.
29	1000	4	137	27/29
29	1000	3	103	13
29	1000	2	68	28
29	1000	3	103	13
29	1000	7	241	11
29	1000	10	344	24
			1000	

The Proof.

			Ells.	*Parts.*
4 takes off	22 *d.*	*per Ell* —	137	27
3 takes off	19 *d.*	*per Ell* —	103	13
2 takes off	15 *d.*	*per Ell* —	68	28
3 takes off	10 *d.*	*per Ell* —	103	13
7 takes off	9 *d.*	*per Ell* —	241	11
10 takes off	8 *d.*	*per Ell* —	344	24
(*Which Fraction is* 4 *Units.*)			1000	116

Had

Had the Quantity in the first Change or Variety been expressed thus:

How might a Composition be made of 8 Ounces, worth 40 *s.* the Ounce, of every sort a quantity?

Then it might have been said,

If 19 require 8 Ounces, what 8,4,2,5? After the manner of the precedent Question.

A Vintner mixed four sorts of Wine together, to the quantity of 500 Gallons; now a Gallon of the first sort was valued at 3 *s.* 8 *d.* the second sort at 3 *s.* the third sort at 2 *s.* 6 *d.* and the fourth sort at 2 *s.* how many Gallons were there, of each sort mixed together, a Gallon of the mixed Measure being sold for 38 *d?*

The Operation according to Rule 3. pag. 113.

38	24	6	6
	32	6	6
	36	6	6
	44	14 — 8 — 2.	24
			42

The

The Compound Proportion.

			Gallons.	*Parts.*
42	500	24	285	30
42	500	6	71	18
42	500	6	71	18
42	500	6	71	18
		Proof	500	84

The Fractions amount to two Units.

What Alloy (either of course Silver, Copper, or other baser Metals) is to be mixed with Bullion, that is, with Gold or Silver in the Mass or Billet of 10 Ounces fine, to abase it to 8 Ounces fine?

Note: That Alloy being of no worth or value, put down a Cypher [0.]

8	10	8	Therefore for every
Alloy.	0	2	8 Oz. take 2 of Alloy.

Many Questions of *Gold* valued in Carrats might be propounded, and also of *Silver* in Ounces, abundantly observed in Books of that nature, to which I could refer you. But to proceed:

The second kind of *Alligation* is *Medial*, that is, When the Price and Quantity of every Simple being apparent and made

made known, the Mean Price or Rate of a Compoſition of thoſe Simples is alſo made known; or by Compounded Proportion of *Multiplication* and *Addition*, the Mean is brought and diſcovered; therefore the *Rule* is this:

1. Add the whole Quantities together for the firſt Number.

2. Sum up in one Total the value of all the Simples for the ſecond Number.

3. Put the Unit [1] in the third place.

Example.

4 Buſhels of Wheat at 7 *s.* *per* Buſhel is to be mixed with 8 Buſhels at 6 *s.* 12 Buſhels at 5 *s.* and with 14 Buſhels at 4 *s.* what is one Buſhel of this Compoſition to be valued at?

Buſh.	*s.*	
4	7	28
8	6	48
12	5	60
14	4	56
38		192

s.

38) 192 ($5\frac{2}{38}$.

To *Prove* it, Multiply the Common Price into the Total of the Quantities; if the Product thereof agree with the Total of the particular Prices, then it is true.

$5\frac{2}{38} \times \frac{38}{1} = 192.$

CHAP.

CHAP. XVI.

Of INTEREST.

INTEREST is the taking of *Use-Money* for any Sum that is lent, whether it be the Use only that ariseth from the Principal Money that is lent, and also the Use thereof, which is termed *Compound* or *Double Interest*. From hence consider,

1. The *Principal Money* that is lent.
2. The *Use* of that *Principal*.
3. The *Time* for how long it is lent.

If therefore you desire to find both the *Principal* and *Interest* joyntly of any Sum given or taken, observe such *Questions* as these, with the *Rule* following.

Question.

J. S. lent to *A. B.* 250*l.* for 9 months at *Simple Interest*, after the rate of 6*l. per Cent.* what will the *Principal* and *Interest* joyntly amount unto?

The Rule.

12 *mo.* gain 6 *l.* what 9 *mo.*
6 3 9
$\frac{27}{6}$ | $4\frac{1}{2}$ *l.*

Then,

100 *l.* gain $104\frac{1}{2}$ *l.* what 250 *l.*
$\frac{100}{1}$ $\frac{209}{2}$ $\frac{250}{1}$
522 | 50
261 | $\frac{1}{4}$ *An.*

	l.	*s.*
	261	5
	250	0
The Interest for 9 months	11	5

But in regard that the Giver and Taker knoweth certainly the Principal Money, I conceive it best to find out the Use only of the Principal, and so the *Operations* will be more brief.

Example, (as before.)

I lent out 250 *l.* for 9 months at 6 *per Cent.* what will the Interest amount to?

The Rule. 100. 6. 250
6

For the Year ——	15 | 00
For 6 Months ——	7 10
For 3 Months ——	3 | 15
Facit	11 *l.* 5 *s.*

If

If the Interest for any number of months be demanded under 12, first multiply the Principal by the Rate of the Interest, then take the Parts of 12 out of the year's Interest.

Example.

At 6 *l. per Cent. per Annum*, what doth 3456 *l.* 6 *s.* 8 *d.* amount to for 10 months?

l.	*s.*	*d.*
3455	6	8
		6
207	38	0 ●
	20	
	60	
7 |	12	
7 |	20	
	4	
	80	

l.	*s.*	*d.*	
207	7	7	
103	13	9 ½	
69	2	6 ¼	
172	16	3 ¾	*Facit.*

If the Interest be for any number of days under a month, take the parts of a month, consisting of 30 days, because 12 times 30 is 360, and $\frac{5}{12}$ remaining.

Amongst Merchants they usually count 12, and not 13, Months to the Year; neither do they reckon 31, 30, or 28

Days to the Month, but from such a Day of such a Month to such a Day of such a Month is a full Month by denomination; the half Month is 15 Days.

Example.

At 6 *l. per Cent. per Annum*, what will 456 *l.* 13 *s.* 4 *d.* amount to for 15 months and 20 days?

456 13 4
6

l. 27|40 00 0
20

s. 8|00

	l.	*s.*	*d.*
For 12 months	27	8	0
For 3 months, $\frac{1}{4}$	6	17	0
For 20 days, $\frac{2}{3}$	1	10	6 *ferè*
Facit	35	15	6 *ferè*

The *Purchaser's Pattern*, *pag.* 77. dislikes the way of Reckoning by *Months*, because of their unevenness, and would have Time in Interest counted by *Days*, or otherwise the Borrower or Lender may suffer wrong, as he discovers at large.

Some again think it improper to accompt thus: At 5 *l.* 6 *s.* or 7 *l. per Cent.* what

what is 100 *l.* worth for $\frac{1}{4}$ or $\frac{3}{4}$ of a Month? And therefore this difference is noted by Mr. *Dalton, I. P. cap.* 30. when a Statute accounteth by the *Year, Half Year*, or *Quarter*, and when by the *Month*; for a *Year, Half Year*, or a *Quarter* of *a Year*, shall be accounted according to the Kalender, and by the *Days* in the Kalender, and not after 28 *Days* to the *Month*; and a *Year* or a Twelvemonth (in the Singular Number) includes the whole *Year* according to the Kalender; but 12 *Months*, (in the Plural Number) or 8 *Months*, or 6 *Months*, *&c.* except in a *Quare Impedit*, shall be accounted after 28 *Days* to the *Month*, for the *Month* by the Common Law of *England* is but 28 *Days: Cooke, p.* 135. And so where-

as $\left\{\begin{matrix}3\\6\\12\end{matrix}\right\}$ *Months* hath but $\left\{\begin{matrix}84\\168\\336\end{matrix}\right\}$ *Days*;

The $\left\{\begin{matrix}\frac{1}{4} \text{ of a } Year\\\frac{1}{2} \text{ of a } Year\\Year\end{matrix}\right\}$ hath but $\left\{\begin{matrix}91\\182\\365\end{matrix}\right\}$ *Days*.

See *Dyer, pag.* 345.

As to the 6 *Hours*, the Law gives no regard to them, and yet every 4th *Year* they make a *Day*, and so make the *Leap-Year* 366 *Days*.

As for *Compound Interest*, which is Use upon Use, the *Decimal Tables* for that purpose are absolutely the best, avoiding the tediousness of Fractions, and speedily Resolving all such Questions as concern the *Forbearance* of *Moneys*, or the *Discompts* or *Purchases* of *Annuities*; All which *TABLES* are largely set forth by Mr. *Moore*, Mr. *Kersey*, Mr. *Hodder*, and divers others.

CHAP. XVII.

Of REBATE.

REBATE was formerly the Allowance of so much as the *Interest* or *Use-Money* amounted unto for the Time of Ante-Payment; but by Practice it was found, that the Lender did sustain some Damage, thô not so much discerned in small as great Sums; therefore it was thought requisite, (amongst Merchants) that the Lender should not sustain any loss, because of his willingness to furnish the Borrower, and therefore they determined, that the Gains which did arise from

from the Months ſhould be added to 100 *l.* and placed in the firſt Number, contrary to the Rate of Intereſt which orders the Gains that iſſueth from the Months to be placed with 100 *l.* in the ſecond place, if Principal and Gains be joyntly deſired.

Example I.

Suppoſe any Commodity is bought, amounting to 300 *l.* at 9 months time, and the buying Man deſires to pay the ſame preſently, Rebating 6 *l. per Cent.* what is the Payment in ready Money?

The Rule.

12 *Mon.* 6 *l.* 9 *Mon.* $4\frac{1}{2}$ *l.*

If $104\frac{1}{2}$ *l.* diminiſheth to 100 *l.* what 300 *l?* *Anſw.* $287\frac{17}{209}$ *l.*

	l.	*s.*	*d.*
The Sum to be paid was	300	00	0
The Sum now to be paid is	287	1	$7\frac{1}{2}$
The rebated Sum is	12	18	$4\frac{1}{2}$

According to the *Rules* of *Intereſt*, the rebated Sum ſhould have been 13 *l.* 10 *s.* which

which would have damnified the Lender or Creditor 11 *s.* 7 *d.* 2 *q.*

Example II.

Delivered a Bond unto a Creditor of 264 *l.* 13 *s.* 4 *d.* which will be due 8 months hence; but upon Rebate at 6 *l. per Cent.* I am willing to make present Payment, how much then is the present Payment?

The Rule.

12 *Mon.* 6 *l.*	8 *Mon.* 4 *l.*
104 *l.*	100 *l.*	264 $\frac{2}{3}$ *l.*
104 / 1	100 / 1	794 / 3

312) 79400 (254 $\frac{152}{312}$ *l.* *Answer.*

	l.	*s.*	*d.*
The Sum to be paid upon Bond was	264	13	4
The Sum now to be paid is	254	9	8
The rebated Sum is	10	3	8

If

If you desire to find the *Rebate* only:

The Rule. 104 *l.* 4 *l.* 264 $\frac{2}{3}$ *l.*

The meaning is this:

If 104 *l.* Principal and Rebatement yield 4 *l.* Rebatement, what 264 $\frac{2}{3}$ *l.*? *Answ.* 10 *l.* 3 *s.* 8 *d.*

Example III.

What's the Rebate of 600 *l.* to be paid at three 4 months, 200 *l.* a time, at 6 *l. per Cent. per Annum?*

	l.	*l.*	*s.*	*d.*	*q.*
Rebate of 200 at 8 *Mo.*		[illegible]		5	3
Rebate of 200 at 12 *Mo.*		11	6	5	0
The rebated Sums		22	18	9	0
Subtracted from		600	0	0	0
The present Money to be paid		557	1	3	0

There is a second manner or sort of Rebatement called *Equation*, which is a Proportion of Equality, when divers times for the Payments of Moneys are brought into one time of Payment.

Ex-

Example.

600 *l.* to be paid at three 4 months, what's the Equated Time?

The meaning is this:

The 600 *l.* is to be divided into three Payments, *viz.* 200 *l.* 200 *l.* 200 *l.* as before, and every Payment to encreaſe 4 months.

The Rule.

Every Sum or Payment of Money multiplied by its Time, and all the Products added together into one Total, divided by the General Sum, gives in Quotient the Time of Payment.

l.			
600	*The Operation.*		
200	4	800	6) 48 (8 Mo. *Anſw.*
200	8	1600	
200	12	2400	
		4800	

This is true *Rebate*, if you count by the *Rules* of *Intereſt*.

Inte-

	l.	*Mo.*	*l*
Intereſt of	200	4	4
	200	8	8
	200	12	12

The Intereſt likewiſe of 600 *l.* for 8 months is 24 *l.*

Notwithſtanding there is a Difference, and a Loſs; for,

	l.	*s.*	*d.*
The Rebate in the one is	24	00	0
The Rebate in the other is	22	18	8
The Difference	1	1	4

So that if you be a Creditor, and may be allowed to have your Operations according to the *Rules* of *Rebate*, you will not meet with ſuch diſadvantage as the *Rules* of *Intereſt* would diſcover.

Many more Queſtions might be propoſed variouſly, but I forbear, and proceed to *Barter*.

CHAP.

CHAP. XVIII.

Of BARTER.

THE first kind of Commerce is *Bartering*, or Trucking Wares for Wares, more practiced in *Asia*, *Africa*, and *America*, than it is amongst us; *Map of Commerce, chap.* 2.

In this sort of Commutation, several things are considerable:

I. To know the Quantity of the Commodity to be bartered, that is, how much of such and such Wares I must deliver of my own to him that is willing to change his Wares with me.

Example I.

How many Pounds of Nutmegs, at 4 *s.* 6 *d. per* Pound, must be delivered in Barter for 246 Pounds of Pepper, at 2 *s.* 4 *d. per* Pound?

The Rule.

Where the quantity of the one is expressed, see the value of that Commodity

dity first, and make the fourth Number the third Number in the second Work, and the Quoient answers the Question.

The Operation.

1 ℔. – 28 *d.* 246 ℔. – 6888 *d.*
54 *d.* — 1 ℔. 6888 *d.* — 127 $\frac{5}{9}$ ℔. *Facit.*

Example II.

Two Barter, the one hath 50 Yards of Stuff at 3 *s. per* Yard ready Money, but in Barter he demands 3 *s.* 6 *d. per* Yard; the other hath Cotton at 1 *s.* 10 *d. per* ℔. how much Cotton is to be delivered in Barter?

The Operation.

1 *Y.* – 42 *d.* 50 *Y.* – 2100 *d.*
22 *d.* – 1 ℔. 2100 *d.* – 95 $\frac{5}{11}$ ℔. *Facit.*

II. To know the Price of the Ell, Pound, Hundred, or the like, in Barter.

Example I.

Two Barter, the one hath Sugar at 8 *d. per* ℔. ready Money, but in Barter he requires 10 *d. per* ℔. the other hath Thread at 2 *s.* 3 *d. per* ℔. ready Money; at what Price ought he to deliver his Thread at *per* ℔?

The Rule.

As the first Man's ready Money, *Is* to his bartering Money: *So* is the second Man's ready Money, *To* his bartering Price required.

The Operation.

8 *d.*—10 *d.* 27 *d.*—33 ¾ *d.* ready Mony.

Example II.

Bartered away with *J. M.* Grocer, 10 Bags of middle Ginger weighing Neat 23 *C.* at 2 *l.* 12 *s. per C.* for 47 Pigs of Lead weighing 7 Fother and 4 ½ *C.* at what Price was the Fother sold at?

The Operation.

1 *C.*— 52 *s.* 23 *C.* —1196 *s.*
141 *C.*—1196 *s.* 19 ½ *C.*— 16|5 *s.*

Answ. 8 *l.* 5 *s.* $\frac{114}{313}$.

III. To know the Price of the Ell, Pound, Hundred, Tun, *&c.* in ready Money.

Example.

A. B. hath Coucheaneel at 25 *s. per* ℔. ready Money, but in barter demands 32 *s.*

E. F.

E. F. delivered in barter Allom for 24 ℔. *per* Tun, what did the Allom coſt in ready Money?

The Rule.

As the firſt Man's bartering Price, *Is* to his ready Money: *So* is the ſecond Man's bartering Price, *To* his ready Money required.

The Operation.

32 *s.* — 25 *s.* 480 *s.* — 37|5

18 *l.* 15 *s.* *Anſ.*

IV. When the ready Money, and the bartering Price of the one, is expreſſed with part of the Over-price in ready Money.

The Rule.

Abate the required Part from the Over-price, and the juſt Price, and theſe two laſt Remains ſhall be the two firſt Numbers in the *Rule of Three*, and the Price of the other the third Number.

Example.

R. S hath 4 Tuns of Iſland Woad at 9 *l.* *per* Tun ready Money, and in barter requires 12 *l.* and beſides he requires $\frac{1}{3}$

part of his Over-price in ready Money; *G. P.* hath 48 *C.* of Crop-mather at 3 *l. per C.* ready Money; how ought he to ſell it *per C.* in barter?

The Operation.

$\frac{1}{3}$ of 12 *l.* is 4 *l.*

	9	12
Subſtract	4	4
Remains	5	8

If 5 *l.* require 8, what 3? *Anſw.* $4\frac{4}{5}$ *l.*

V. When the ready Money and bartering Price are expreſſed with the Gain *per C.* and part of the Over-price in ready Money.

The Rule.

See at ſo much *per C.* what the firſt Merchant's bartering Price comes to; then from the fourth Number ſubſtract the part of the Over-price, and abate it from the Price of the ready Money, and alſo from the bartering Price; thoſe two Remains are the two firſt Numbers in the *Rule of Three*, and the laſt Price the third Number.

Ex-

Example.

R. S. hath 8 Cask of Argall, Neat 40 *C.* 2 *Quar.* at 28 *s. per C.* ready Money, but in barter demands 36 *s.* and will gain 8 *per C.* and yet requires the half of the Over-price in ready Money; *B. D.* hath 6 Cask of *Spaniſh* Indico, Subtle 468 ℔. at 4 *s. per* ℔. ready Money; how ſhall he ſell the Pound in barter?

The Operation.

				s.	d.
100.	108.	36.		38	10
			½.)	19	5

	s.	d.
	28	0
	19	5
Rem.	8	7

	36	0
	19	5
Rem.	16	7

If 8 *s.*–7 *d.* 16 *s.*–7 *d.* 4 *s.* *Anſw.* 7 *s.* 8 ½ *d.*

VI. When the ready Money, bartering Price, and part of the Over-price, is expreſſed by the one, and only the ready Money to gain ſo much *per C.* named by the other.

The Rule.

See firſt, at ſo much *per* C. what the ſecond man's ready Money amounts unto in the Gain; then ſubſtract as in the former Queſtion, making the ſecond Merchant's Gain the third Number in the *Rule of Three.*

Example.

M. O. at *Hull* having 20 Blue Liſts of *Devonſhire* Kerſies, values them at 24 *s.* *per* Piece ready money in barter 32 *s.* and ¼ part of the Over-price; *T. S.* Factor offers him 4 Bales of Pepper, Neat 2400 ℔. at 12 *s.* *per* ℔. and yet he will ballance the Barter ſo as to get 12 ℔. *per* C. Now at what Price ſhall he ſell his Pepper in barter *per* ℔?

The Operation.

100 ℔. — 112. 12 *s.* — 13 *s.* ½.

¼ of 32 *s.* is 8 *s.*

	24	32
	8	8
Rem.	16	24

16 — 24. 13 ⅓ — 20 *s.* *Anſw.*

VII. When

VII. When the quantity of the Commodity, the ready Money, the bartering Price with Loſs *per Cent.* is expreſſed in the one, and only the bartering Price in the other, to find out the ready Money.

The Rule.

Firſt ſee what the firſt man's Loſs is at ſo much *per Cent.* then ſee what the quantity of his Commodity amounts to by the bartering Price; then take that part required for ready money out of the Product, and reſerve it for Subſtraction; then caſt up again the ſame Commodity by the loſt Price, and ſubſtract the reſerved Product out of the firſt and ſecond price, what remains are the two firſt Numbers in the *Rule of Three*, and the ſecond man's bartering price the third Number.

Example.

T. P. hath 316 ℔. of *Spaniſh* Wool at 2 *s.* 10 *d.* *per* ℔. ready money, in barter 3 *s.* 4 *d.* *per* ℔. and yet he is a loſer 7 *l.* *per C.* therefore requires half of the Over-price in ready money: *S. B.* ſells and delivers him Rape-Oyl at

18 *l.*

18 *l.* 10 *s. per* Tun; what cost the Rape-Oyl in ready money *per* Tun?

The Operation.

100 — 40 *d.* 93 ℔. — 37 *d.*

	316		316
	37		40
	2210		12640
	948	⅓.) Rem.	6320
	11692		
	6320		18 *l.* 10 *s.*
Remains	5372		20
			370

6320—5372. 370 *d. Answ.* 15 *l.* 14 *s.* 6 *d.*

Many more *Examples* might be stated, but these few *Rules* will very much help you.

CHAP.

CHAP. XIX.

Of LOSS and GAIN.

THE ſecond kind of Commerce is *Bargaining*, *Buying*, or *Selling*, wherein *LOSS* and *GAIN* is comprehended, diſcovering the Increaſe or Decreaſe of a Merchant's Eſtate; and herein it may be diſcovered, upon ſundry accompts, more Generally, or more Particularly.

I. More *Generally*, either upon ready Moneys and Commodities, as *Houſes*, *Lands*, *Rents*, *Legacies*, *Ships Parts*, and *Wares*; or upon *Debts* due unto us from others, or *Debts* due from us to others.

Example I.

G. F. hath a Houſe ſtanding in *Bury St. Edmonds*, whoſe Principal with a Legacy coſt 450 *l.* there is due upon the ſaid Houſe a Year's Rent 40 *l.* This 40 *l.* in Traffick Accompts is looked upon as Gain.

Ex-

Example II.

A. B. buys 682 Yards of Cloth for 306 *l.* 18 *s.* and selling the Yard for 7 *s.* now what is gained or loſt upon the Yard?

Yards.	*l.*	*Yard.*	*s.*
682 ——	306 $\frac{9}{10}$.	1 ——	9.

Here you ſee 2 Shillings loſs in every Yard.

Example III.

A Merchant receiveth for his Accompt 86 Pipes of Oyl, which coſt at *Thoulon* 1460 *l.* Beſides there 12 *l.* for Freight to *London*, 122 *l.* for Factors Expences, 25 *l.* for Cuſtom, and Impoſt here 190 *l.* The Merchant deſires to gain 200 *l.* in disburſing of his Money: *Qu.* How much may 50 of theſe Buts be ſold for?

l. *The Operation.*

1460
12
122
25
190
200
2009

Pi. *l.* *Pi.* *l.*
86 — 2009. 50 — 1168 $\frac{1}{43}$ *Facit.*

Example IV.

Shipped to *Amsterdam* 34 Pieces of Broad Cloth, which coſt at *London* 10*l.* 15*s.* *per* Piece; beſides for Cuſtom, Freight, and other Disburſments, 5*s.* 6*d.* *per* Piece; They were ſold there for 16*l.* 12*s.* *per* Piece: *Queſt.* What was gained in the whole?

l.	*s.*	*d.*
10	15	0
00	05	6
11	00	6

34 Pieces.

	11	00	6
Coſt	374	17	0

34 Pieces.
16 $\frac{3}{5}$
565 $\frac{3}{5}$

	l.	*s.*	*d.*
	565	08	0
	374	17	0
Anſw. Gain'd	190	11	0

II. But

II. But more *Particularly*, that which is intended in this Chapter, is to find out the *Loſs* and *Gain per Cent.* conſidered either without Time, or with Time: In both which, it is branched under theſe principal Heads.

1. To know the Gain or Loſs *per Cent.* upon *Moneys.*

Example I.

The Principal and Gain which a Factor received was 624 *l.* his clear Gains amounted to 68 *l.* Now what was the Gain upon the 100 *l?*

The Rule.

Firſt ſubſtract the clear Gains from the Principal and Gains, what remains is the firſt Number; The clear Gains the ſecond Number; And the Principal with the Gains the third Number; Thus:

l.
624
68
—
556 —— 68 —— 624 | 76 $\frac{44}{139}$ *Facit.*
—
l. *l.* *l.*

Example II.

A Grocer in exchanging Spices for other Commodities loſt 4 *l. per Cent.* in 800 *l.* what did he loſe in the whole?

Anſw. Loſt 32 *l.*

2. To

2. To know the Profit or Loss *per Cent.* upon Commodities retail'd, either *per C. per* Ell, *per* Yard, or *per* Tun, *&c.*

Example I.

If 1 Hundred Weight cost 2 *l.* 10 *s.* and is sold or retailed for 3 *l.* what is gained *per Cent.* or upon the 100 *l.*?

The Rule.

As Stock, *Is* to Profit or Loss; *So* is 100 *l.* *To* the Gains or Loss: And therefore, Stock is the first Number, Profit or Loss the second Number, and 100 *l.* the third Number; Thus:

Stock.	*Profit.*	*l.*	*Gain.*
$2\frac{1}{2}$ —	$\frac{1}{2}$ —	100.	20 *Facit.*

Example II.

Devonshire Kersies bought for 4 *s.* 6 *d.* *per* Yard, and sold at 4 *s.* 2 *d.* what is the Loss *per Cent?*

4 *s.* $\frac{1}{2}$ — 4 *d.* — 100 *l.* — 7 *l.* $\frac{11}{27}$ Loss. *Facit.*

Example III.

A Factor receives 4 Bags of middle Ginger, neat 14 *C.* at 2 *l.* 15 *s.* *per C.*

and 3 Bags of large Ginger, Neat 8 C. at 3 *l.* 10 *s. per* C. if he ſell them for 2 *l.* 5 *s. per* C. one with another, what is the Profit or Loſs, and how much *per* C?

The Operation.

	l.	*s.*
14 C. at 2 *l.* 15 *l. per* C.	38	10
8 C. at 3 *l.* 10 *s.*	28	00
In Total	66	10
22 C. at 2 *l.* 5 *s.*	49	10
Remains	17	00

Then,

l. *l.* *l.*
If 66 ½ — 17 — 100. *Facit* 33 $\frac{11}{133}$ Loſs.

Example IV.

20 Pieces of Bockin double Bayes, quantity 1000 Yards, making 2 Bales, coſt 80 *l.* and 1 Piece being ſold for 5 *l.* 10 *s.* *Qu.* Whether there was Profit or Loſs, and how much *per Cent?*

l. *l.* *l.*
4 — 1 ½ — 100. *Facit* 37 ½ Profit.

3. How

3. How Wares or Commodities ought to be sold for Profit or Loss *per Cent.*

Example I.

Suppose a Pound of Raisins of the Sun cost 6 *d.* how ought it to be sold for to gain 4 *l.* 10 *s.* *per Cent?*

The Rule.

100 *l.* requires the first place; 100 *l.* with Profit added, or Loss deducted, the second place; and what the Commodity cost at first, the third place.

l.		*d.*	
100 ——	$104\frac{1}{2}$ ——	6.	*Facit* $6\frac{1}{2}$. $\frac{16}{100}$.

Abbr. *Facit* $\frac{2}{25}$.

Example II.

Bought a Bargain of Hops for 4 *l.* 12 *s.* *per C.* how shall I put off the same so, as to lose but 7 *l.* 10 *s.* *per C?*

l.		*l.*	*l.* *s.* *d.*
100—	$104\frac{3}{5}$ —	$92\frac{1}{2}$.	*Facit* 4 5 1 Loss.

Fraction Abbr. $\frac{1}{5}$ *Facit.*

Example III.

A Merchant hath 100 Hogſheads of Tobacco which coſt him 425 *l.* he deſires to know how to ſell every Hogſhead to gain 8 *l. per Cent?*

				l.	*s.*	*d.*
100 —	108	— $4\frac{1}{4}$.	*Facit*	4	11	$9\frac{3}{5}$

Or thus:

100 *l.* Z 8 *l.* *Hogſh.* 100 Z 459 *l.*
425 Z 34. *Hogſhead* 1 Z 4 *l.* 11 *s.* 9 *d.* $\frac{3}{5}$ *Fa.*

So much it muſt be ſold for to gain 8 *l. per Cent.*

4. To know what Stock was laid out at firſt when there is Profit or Loſs *per Cent.*

Example I.

An Adventurer ſelling *Colcheſter* Serges at 6 *s.* 4 *d. per* Yard, gained 18 *l.* 16 *s. per Cent. Qu.* What paid he at firſt for them *per* Yard?

The Rule.

Let the Gain added to the 100 *l.* or the Loſs deducted from the 100 *l.* be the firſt

first Number; 100 *l.* the second Number; and the selling Price the third Number.

l. *l.* *d.* *s.* *d.*
118 $\frac{4}{5}$ — 100 — 76. *Answ.* 5 3 $\frac{118}{119}$ *per* Yard.

Example II.

10 Pieces of *Suffolk* Violets, about 28 Yards, each being sold at 17 *l.* *per* Piece, whereupon 22 *l.* was lost *per C.* what did the 10 Pieces cost at first?

78 *l.* — 100 — 170 *l.* *Facit* 217 *l.* $\frac{74}{78}$.

Example III.

40 Pieces of Perpetuanos (Yard broad) were sold for 120 *l.* and there was gain'd 16 *l.* *per Cent.* *Qu.* How much did the Piece cost the first Peny?

116 —— 100 —— 3. *Facit* 2 *l.* $\frac{68}{116}$.

5. To know the Profit or Loss *per Cent.* when there is a rising or falling Market.

Example I.

At the beginning of *Sturbridge* Fair a Retailer sold Hops for 6 *d.* *per* Pound,

and two days after ſold the reſt for 9 *d. per* Pound; now by the firſt Sale his Profit was 7 *l. per Cent.* what then was his Profit by the latter Sale?

The Rule.

The firſt Price requires the firſt place; Stock with Profit added, or Loſs ſubſtracted, the ſecond place; and the ſecond Price the third place.

The Operation:

6 *d.* — 107 — 9 *d.* — 160 $\frac{1}{2}$ *l.* Stock & Profit.

Anſw. Gained 60 $\frac{1}{2}$ *l. per C.*

Example II.

A Merchant tranſporting Corn, ſold it for 22 *s. per* Coomb, and loſt 14 *l. per Cent.* notwithſtanding he was conſtrain'd to ſell the reſt for 16 *s. per* Coomb, what did he loſe by the laſt Sale?

22 *s.* — 86 *l.* — 16 *s.* — 62 $\frac{1}{2}$ *l.*

So that he loſt by the laſt Sale 47 *l.* 9 *s.* 2 *d.*

As the former Heads diſcover Profit and Loſs without Time; ſo,

6. This

6. This laſt Head holds forth Profit or Gain, and Loſs with Time, performing ſuch Queſtions as belong hereunto, by the *Double Rule of Three.*

Example I.

If one Pound of any Commodity bought for 2 *s.* ready Money, and is ſold again for 2 *s.* 3 *d.* at 4 Months, how much is gained *per Cent. per Annum?*

2 *s.* — 3 *d.* — 100 *l.* — 12 $\frac{1}{2}$ *l.*
4 *Mon.* — $\frac{25}{2}$ — 12 *Mon.* — 37 $\frac{1}{2}$ *l. Facit.*

Example II.

Bought 24 Laſts and 6 Barrels of *Gottenburgh* Tar for 9 *l. per* Laſt ready Money; now I deſire to know for how long time one Laſt at 8 *l.* 2 *s.* is to be ſold at to loſe 16 *l. per C?*

9 *l.* — 18 *s.* — 100 *l.* — 10 *l.*
16 *l.* — 12 *Mo.* — 10 *l.* — 7 $\frac{1}{2}$ *Mo. Facit.*

Example III.

17 Fother of Lead, and 9 C. 3 *Q.* 14 lb. was priz'd at 9 *l.* 15 *s. per* Fother, amounting to 170 *l.* 13 *s.* 9 *d.* afterwards one Fother was delivered for 9 *l.* to be paid

at

at 10 Months, and to loſe 22 *l.* *per* C. in 12 Months; *Qu.* What did the Fother of Lead coſt in ready Money?

12 *Mo.* — 22 *l.* — 10 *Mo.* — 18 $\frac{5}{9}$.
81 $\frac{2}{3}$ — 100 — 9 — 11 $\frac{1}{459}$ *l. Facit.*

Many more Examples might be added; but to conclude this Chapter, obſerve, That in many of the precedent Examples the firſt and third Numbers are not of the ſame denomination, and yet the *Rule* is true; becauſe, That look what Proportion there is between the firſt and ſecond Number, the ſame Reaſon or Proportion there is between the third and fourth Numbers, as before demonſtrated.

CHAP.

CHAP. XX.

Of EXCHANGES.

THE third kind of Commerce is *EXCHANGE*, held to be the most Mysterious Art of Merchandize, and is nothing else but the Giving or Taking up so much Money in one Place or Country, to be Repaid by another that dwells in another Place or Country; wherein is considerable,

1. The *Parr*,
2. The *Rates*, } in Exchange;
3. The *Prices*,

Together with the *Usances*, *Double Usances*, and *Half Usance*.

And in a *Bill of Exchange*, every thing requisite to Exchange is so exactly put down, that (amongst Merchants) the Bill is equivalent to any Bond whatsoever.

Some think to equalize, or make even, *Foreign Coins*, *Weights*, or *Measures*, with our

our *Engliſh Coins*, is too burthenſom for any *Engliſh* Perſon: Others again imagin, that thoſe who buſy themſelves much in Trading, and do practice much in Exchanges, know what Analogy or Proportion the *Coins*, *Weights*, and *Meaſures*, of one Kingdom or City bears unto thoſe of another place; and therefore, for their own uſe, they may frame what *Tables* they think fit to diſpatch their buſineſs.

Having touched upon ſome Foreign Coins in *Reduction*, ſome farther Addition ſhall be made in this place.

In many Books there hath been a great Miſtake concerning the Exchanging of *Flemiſh* Money with *Engliſh* Money, becauſe they ſay, That 7 *l. Flemiſh* are 6 *l. Engliſh*, 7 *s. Flemiſh* 6 *s. Engliſh*, and 7 *d. Flemiſh* 6 *d. Engliſh*.

This Error is grounded upon the *Merchant's Jewel*, a Book highly commended for its Ingenuity; and yet ſuppoſed, that the Author never put in theſe Words into his Book:

Pounds Engliſh, *Shillings*, *and Pence*, *multiplied by* 6, *and divided by* 7, *are* Flemiſh *Pounds*, *Shillings*, *and Pence*.

Whereas

Whereas this *Rule* is contradicted by the *Merchant's Mirror*, and others, concluding that 1 Pound *Flemiſh* hath but 12 Shillings *Engliſh*; ſo that 1 Pound Sterling is 10 Gilders exchange at 33 *s.* 4 *d.* *Flemiſh* for 1 Pound Sterling, and each Gilder is 20 Stivers, and each Stiver 16 Penninghens: So now conſidering that the Moneys in *Flanders* having a Correſpondency with the *Netherlands* in their Accompts,

The RULE *is this:*

If one entire Pound *Flemiſh* be 3 Fifths of a Pound *Engliſh*, how many Pounds *Engliſh* for 100 Pounds *Flemiſh*?

Fl. *Engl.* *Fl.*
1 ——— $\frac{3}{5}$ ——— 100. *Anſw.* 60 *l.* Sterl.

How many Pounds *Flemiſh* are there in 300 *l.* 6 *s.* 8 *d.* Sterling?

If $\frac{3}{5}$ *l. Engliſh* be 1 *l. Flemiſh*, what 300 $\frac{1}{3}$ *l.*
Facit 500 $\frac{5}{9}$ *Flemiſh.*

Sometimes Moneys are inhauſted, or debaſed, and then Exchanges are either higher or lower.

Further-

Furthermore Bankers, Exchangers, and Merchants, have appointed a common course of Exchange in particular and eminent Places, as in *Italy*, *Spain*, *France*, *Portugal*, *Flanders*, *Germany*, and *England*; *London*, being the chief Place appointed for *England*, Exchangeth with many other Places beyond the Seas in the denomination of Pence Sterling, but with *Antwerp* and *Colonia* by the Pound Sterling; *Map of Commerce*, *chap.* 291. But because the currant Prices and Rates with these Places are so subject to Change or Alteration, therefore no positive *Rules* can be truly made to write them down; and yet in regard Exchange is so beneficial in it self, some Calculations may be made (as was before hinted) by such as busy themselves much in Trading.

Now that which remains, is to shew and declare the Operation, and Working of Exchanges, according to *Arithmetick.*

Example I.

A *Venetian* Factor receives in *London* 500 *l.* Sterling, taking *posito* 54 *d.* Sterling for 1 Ducat in *banco* of 6 $\frac{1}{5}$ *l.* Money of

of *Venice*; *Qu.* How many Ducats shall the Bill of Exchange have Credit for in *Venice*?

The Operation.

l.	*Ducat.*	*l.*	*Ducats.*
$\frac{9}{40}$	1	500.	*Facit* 2222 $\frac{2}{9}$.

Note, That in *Venice* there is a difference between currant Money, and Money in *banco*; so that there are two sorts of Ducats, valued at such a Rate as the Exchange will admit; *Map of Com. c.* 158. The currant Ducat valued sometimes at 3 *s.* 4 *d.* and the Ducat in *banco* at 4 *s.* 2 *d.*

Example II.

A Merchant at *Amsterdam*, by order, hath drawn 4800 Marks Lubicks upon *T. S.* at *Hamborough*, his Bills delivered to *C. P.* payable to him at 20 days sight: Exchange 1 $\frac{1}{2}$ Mark for 35 Stivers, and Exchange to *London* at 34 *s.* 4 *d.* *Qu.* How many Pounds Sterling at *London*?

Bring your Stivers into Gilders, and state it thus:

Mark.	*Gilder.*	*Marks.*	*Gilders.*
$\frac{3}{2}$	$\frac{7}{4}$	4800	5600.

Facit 560 *l.* Sterling.

Observe, That the Mark of *Lubick* hath been accounted one of the Imaginary Coins in *Germany*, and therefore the Currant and Real Coins are much to be enquired after.

Example III.

A Bill of Exchange is accepted at *Dantzick* from *London* of 3670 Florins *Polish*, the Value delivered there at 233 Grooſs for 20 *s.* Sterling; *Qu.* How much Sterling Money was paid at *London*?

Florins.	*l.*	*Florins.*	*l.*
233 ——	1 ——	3670. *Facit*	472 $\frac{114}{233}$.

It is to be obſerved, That a Florin or Silver Gilder in *Poland* is valued at 30 *Polish* Grooes, which is 2 *s.* Sterling; and moreover, Silver Coins have been uſed amongſt the *Polonians* between 3 and 400 years, and not before; *Map of Com. c.* 223.

Example IV.

A Merchant at *London* draws upon his Factor at *Amſterdam* 4800 Gilders, delivering his Bill to *E. S.* payable to him at double uſance; Exchange at 34 *s.* 8 *d.* per

per Pound Sterling; *Qu.* How much Sterling Money does it amount to?

Stivers.	*l.*	*Gilders.*	*l.*
208	1	4800.	*Facit* 46 1 $\frac{7}{13}$.

Note, That 6 Stivers make a *Flemish* Shilling, and 20 Stivers make a Gilder: By Usance understand 1 *Month*, and by double Usance 2 *Months*, after the Date of the Bill.

Example V.

A Merchant at *London* receives a Bill of Exchange from *Amsterdam* of 200 *l.* Sterling, to be paid to *A. B.* for 300 *l. Flemish* delivered at *Amsterdam*; *Qu.* At what rate did the Exchange go?

Sterling.	*Flemish.*	*Sterl.*	*Flem.*
200 *l.*	300 *l.*	1 *l.*	*Facit* 1 $\frac{1}{2}$ *l.*

Example VI.

At *London* a Bill of Exchange is drawn upon *Jan Jacobs Van Halma* at *Hamburrough* of 1600 Gilders, at 33 *s.* 4 *d. Flemish* for 20 *s.* Sterling; *Qu.* What is the Sterling Money?

Gilders.	*l.*	*Gilders.*	*l.*
6	$\frac{3}{5}$	1000.	*Facit* 100.

Ex-

Example VII.

Suppoſe the Exchange from *Paris* to *London* goes at 60 Sols Turnois for 64 *d.* Sterling; *Qu.* How many Livers Turnois muſt be paid at *Paris* to receive in *London* 500 *l?*

l. Sterl.	*Turnois.*	*l.*	*Turnois.*
4 : 25	60	500.	*Facit* 11250.

Note, That 60 Sols make 72 Pence, which is the *French* Crown: Moreover, *French* Monies have been inhanſed and raiſed as neceſſity requires, and therefore make Enquiry for your Profit.

Many are the *Examples* which might be propoſed herein, as alſo of *Weights* and *Meaſures*, which might have been drawn out of Proper Factorage, and Company Accompts: But finding that many have largely Treated upon this Subject of *Exchanges*, I ſhall forbear to ſay any more at preſent, intending brevity in what I have now written.

FINIS.